

# **Proposal**

to the

## **Global Geodetic Observation System (GGOS)**

for the GGOS component:

### **GGOS Portal**

based on

Call for Proposals

for the

GGOS Coordination Office (CO) and GGOS Portal

(Version: July 7, 2008)

### **Contributing Institution:**

Bundesamt für Kartographie und Geodäsie (BKG)

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# Structure of BKG Proposal for the GGOS Portal

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## **1 Summary**

BKG has a profound expertise in the domain of portal applications and offers the establishment and long-term operation of the GGOS Portal.

In its final stage the GGOS Portal will offer for all relevant IAG products a set of tools for organized knowledge discovery including visualization to assist identification and selection of appropriate resources, i.e. to information as well as to data and products of the heterogeneous IAG services. To develop and implement the GGOS Portal modern information technologies will be applied, as for example professional Content Management Systems, standardized Web Services or Java technology to realize applications for data visualization and analysis. An ISO standardized metadata catalogue will serve as the backbone to apply the information system for data discovery and subsequent data processing. BKG will support the various IAG components and services by consultation and software tools like e.g. templates and editors to create standardized metadata sets for all IAG products.

The development of the GGOS portal will be in close cooperation with GEO activities by using standards and interoperability arrangements of the GEOSS architecture to provide a substantial contribution to the Global Earth Observing System of Systems (GEOSS). BKG participates with its experiences in standards and interoperability arrangements in the GEOSS Architecture Implementation Pilot to confirm the interoperability of the GEOSS Clearinghouse.

## **2 Organizational structure and background experience of BKG**

### **2.1 Organizational structure of BKG**

The Bundesamt für Kartographie und Geodäsie (BKG) - Federal Agency for Cartography and Geodesy - is a federal authority assigned to the Federal Minister of the Interior. In 1997 the BKG became the succeeding agency of the former Institute for Applied Geodesy (IfAG) which was founded in 1952. The manifold functions and tasks of the BKG include, among others, the provision of geodetic reference data and basic spatial data for the needs of the Federal Government, the administrative, economic and scientific sectors as well as for the citizens.

BKG maintains the GeoPortal.Bund, a GeoDataCentre, geodetic observatories and supports IAG services (IBS, IERS, IGFS, IGS, ILRS, IVS) by observations, analysis and combination centers, data bases, data information systems and a central bureau.

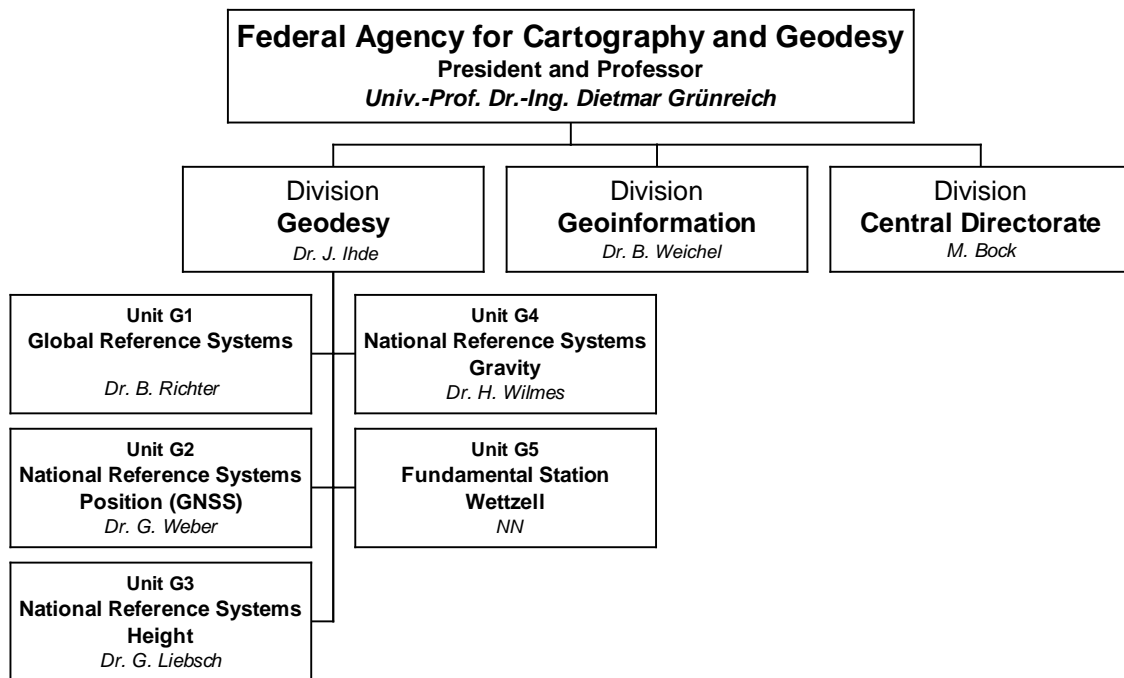
Our product range comprises geodata, maps, publications, reference systems and information services. Further, beyond Germany's borders BKG contributes in close cooperation with its European and international partners to the establishment of a European and global Geodata Infrastructure.

The BKG employs about 310 persons at three branches. It is divided into three departments: Geodesy, Geoinformation and Central Administration. The geodetic department consists of about 70 persons with 30 scientists.

The core task of the geodetic department is the establishment and maintenance of reference networks for three dimensional point positioning, for height and for gravity. These fundamental data form the basis for all kinds of survey work, i.e. for the referencing of geodata as well as for environmental monitoring purposes.

BKG operates in collaboration with the Technical University Munich the Geodetic Observatory Wettzell in the Bavarian Forest, with the facilities for Very Long Baseline Interferometry (VLBI), Laser Ranging to Satellites (SLR) and to the Moon (LLR). Two other Fundamental Stations have been established in Concepcion (Chile) and O'Higgins (Antarctica). BKG operates about 45 permanent installed GPS+GLONASS stations in the frame of the IGS – such as the station in the Antarctica or in Lhasa/Tibet –, in the European Reference Frame EUREF and in the national frame GREF.

The BKG has the responsibility for the IERS Central Bureau including its data and information system. It maintains IVS Data, Analysis, and Combination Centers and an ILRS Analysis Center. For the IGS it maintains a European Data Centre containing all European GNSS reference stations and is strongly involved in the data analysis of the EUREF Permanent Network and of the European Vertical Reference Network (EUVN).



**Figure 1 Organizational Structure of BKG**

Computation and communication techniques are employed for the determination of orbits of the GPS+GLONASS navigation satellites, the derivation of up-to-date coordinates in the European Terrestrial Reference System ETRS89, and for the performance of coordinate transformations into uniform reference systems.

Furthermore, BKG's gravimetric activities pursue the objective of realizing and maintaining a precise and uniform gravity standard as well as of providing basic data for the computation of gravity anomalies and geoid models. For this purpose, measurements are carried out by means of stationary Superconducting Gravimeters as well as with transportable absolute and spring gravimeters. The growing numbers of absolute gravity measurements make it desirable to get an overview about existing observations, locations and gravimeters by means of metadata. For this purpose, a prototype of a relational database is designed and implemented at BKG.

The BKG, Branch Office Leipzig takes care of the IAG Bibliographic Service. For the IAG Bibliographic Service, as one of the oldest IAG services, geodetic journals and other periodicals, publications of research institutes, manuals and text books as well as congress papers are being analyzed. The excerpts are stored in the literature database Geodesy, Photogrammetry and Cartography GEOPHOKA<sup>1</sup>. GEOPHOKA has been managed since the end of 1984. On July 01, 2008 its total stock was more than 60.000

<sup>1</sup> [http://www.geodatenzentrum.de/mires/EasyQuery\\_F.jsp?lang=en&QNM=EasyQuery.jsp](http://www.geodatenzentrum.de/mires/EasyQuery_F.jsp?lang=en&QNM=EasyQuery.jsp)

literature records and it is increasing by about 2 000 records every year.

## 2.2 BKG's expertise in the domain of Web Portals

### 2.2.1 Examples

BKG hosts a variety of Web sites and portals, thus having a comprehensive knowledge for the realization of the GGOS Portal. The most important ones with respect to this proposal are:

**GeoPortal.Bund:** <http://geoportal.bkg.bund.de/>

The GeoPortal.Bund offers a unique access point to the geodata resources of all public institutions in Germany. The data are stored locally at the data provider's servers and the user can search the metadata databases of all data providers by a Catalogue Service Web (CSW) interface based on an ISO 19115<sup>2</sup> metadata profile. The data can be displayed by a so-called Geoviewer. Since the viewer is based on the Web Map Service (WMS) standard, discovered datasets or map layers supporting the WMS standard can be viewed in interactive maps via the Internet. Moreover, all worldwide available datasets provided via the WMS standard can be viewed together with the Geoviewer. Furthermore a 3-D terrain viewer is available.

The Web site also provides calendars, hot spot information, newsletter and a collection of worldwide available interactive maps.

**GeoDatenZentrum:** <http://www.geodatenzentrum.de/>

The GeoDatenZentrum provides information about the basic geodata of the Federal States and the Federal Government of Germany. Several services and interactive maps are available to order, download, search or process the data. The spatial base data of Germany are provided via standardized Web services, like CSW, WMS, WFS (Web Feature Service). Moreover, a Coordinate Transformation Service (CTS)<sup>3</sup> and services to search for geographic or historical names are available.

**IERS Data and Information System:** <http://www.iers.org>

The Web site of the International Earth Rotation and Reference Systems Service provides general information on and explanations of Earth rotation and global reference systems as well as with respect to the data and products of the IERS. The geodetic space techniques and their associated services are described in detail and links to

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<sup>2</sup> ISO 19115 : 'Geographic Information – Metadata'  
[http://www.iso.org/iso/iso\\_catalogue/catalogue\\_tc/catalogue\\_detail.htm?csnumber=26020](http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=26020)

<sup>3</sup> <http://crs.bkg.bund.de/crs-eu/>

service-specific resources are given.

The products of the various Product Centers of the IERS are described with metadata compliant to the ISO 19115 standard 'Geographic Information - Metadata'. Based on the metadata search interfaces are provided for a temporal, spatial or keywords based search of data. Moreover, a CSW interface is being realized to be able to search the IERS metadata from the GeoPortal.Bund.

The Web site facilitates the communication within the IERS by meeting calendars, bibliography, meeting summaries, working group activities and workshop presentations. Finally, basic functionalities are given, like e.g. news, announcements, FAQs, glossary, etc.

**Earth Rotation Information System (ERIS):** <http://www.erdrotation.de>

The aim of ERIS as a part of the research unit FOR 584 "Earth Rotation and Global Dynamic Processes" is the development of a virtual Earth rotation system for geodetic and geoscience applications. An integral part within ERIS is the common Web portal called Earth Rotation and Global Dynamic Processes realizing the entry point for all services provided by the project. The portal's homepage gives access to three subsections, one for the public presentation of the research unit, one for the information system ERIS, and one for internal communication. Similar to the IERS Web site the Web portal provides ISO compliant metadata and several functionalities to facilitate the communication within the research unit.

## **2.2.2 Architecture behind**

### **2.2.2.1 CMS Government Site Builder (GSB)**

Since 2004 all Web sites at BKG are realized with the Government Site Builder (GSB)<sup>4</sup>, the Content Management System for the German public federal government.

The GSB offers flexible modules for all typical tasks of a CMS. Thus, Web sites can be implemented without time-consuming proprietary developments. External applications can be tied by an open interface and the highly scalable system together with caching mechanisms guarantees high performance even at high web traffic. The GSB supports multilingual Web sites, protected areas within a Web site, link consistency, guest books, multimedia, newsletter, RSS generator, and website accessibility.

### **2.2.2.2 Installation and maintenance of a clearinghouse**

In the framework of the GeoPortal.Bund and the IERS Data and Information System

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<sup>4</sup> <http://www.government-site-builder.de>

BKG has developed a metadata catalogue based on the ISO 19115 standard for all IERS products. For metadata search an interface has been developed within GeoPortal.Bund to browse the local metadata catalogues at various institutions by realizing a Catalogue Service Web based service. Since the IERS metadata database has also connected to the GeoPortal.Bund search interface, all components for an interoperable, interdisciplinary and interinstitutional metadata search have been realized at BKG. In particular, the interoperability can be guaranteed by relying on standards like ISO 19115 and the CSW specification. However, metadata catalogues based on other standards like e.g. NASA's DIF standard used in the Global Change Master Directory (GCMD) can easily be linked by using the CSW standard.

Within the GGOS-D project, founded by the German Ministry of Technology and Science, the IERS specific metadata profile has been extended to datasets stored in SINEX files. Thus, the metadata profile has been extended towards a GGOS specific metadata profile considering a variety of dataset from the IERS and the geodetic space techniques. In the future this profile has to be further adapted in order to be able to capture all products of the IAG services relevant to GGOS.

BKG has submitted an approved proposal for an ISO register for geodetic codes and parameters. Thus, expertise is already at hand how an ISO register has to be developed according to ISO 19135.

#### 2.2.2.3 Distributed applications for data mining

Within ERIS and GGOS-D tools and services have been developed to parse and merge, to visualize and to analyze data. E.g. an EOP Reader to extract and merge EOP data from one or more data series or a SINEX parser to extract geodetic-geophysical parameters from (weekly) SINEX files, a Plot-Tool to visualize XML based or CSV data. Additionally, a Java based interactive data analysis tool is being developed and will be operational at the end of 2008. This tool will be available on the IERS server as an applet version and also via the Java Web Start technology for use on the clients environment. Thus, the users are able to test the tool on the IERS server but also to download, install and customize the tool in their own environment by using the Java Web Start version.

### **3 Description of Proposed GGOS Portal**

#### **3.1 Concept for a GGOS Portal**

The GGOS Portal will be a unique access point for all GGOS products (see fig. 2). Multiple entry points and levels will guide the user to the anticipated information.



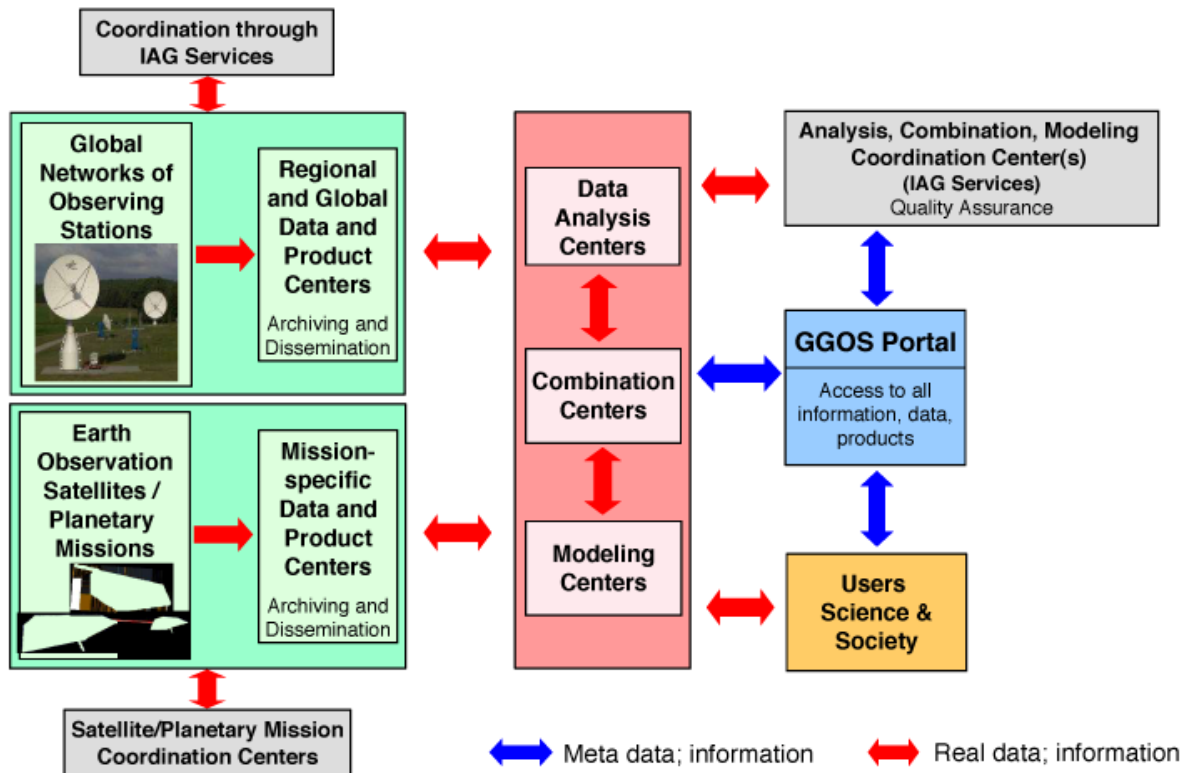
However, the success of the GGOS portal will depend on data and information providers accepting and implementing a set of interoperability arrangements, including technical specifications for collecting, processing, storing, and disseminating shared data, metadata and products. GGOS interoperability will be based on non-proprietary standards, with preference given to formal international standards.

Data, products, and information from contributing IAG services will be catalogued in a publicly accessible clearinghouse maintained collectively under the GGOS Portal. The thesauri used in the catalogue will be subject to GGOS interoperability specifications, including the standard search and portrayal services.

The architecture of the GGOS Portal will be developed in such a way that the interoperability is ensured within the GGOS community but also to other systems e.g. GEOSS. To facilitate the exchange of information by Web services the GGOS Portal will use standards and interoperability arrangements recommended by GEOSS.

The concept to establish the GGOS Portal is based on a two step approach. In a first step a rapid prototype should be realized as soon as possible. Within a time frame of 6 months this prototype will be available offering all basic features of the GGOS Portal to the users in a preliminary but fully operational version.

The prototype GGOS Portal could be realized in such short time because of the above described comprehensive expertise and the software tools being available at BKG. As a remarkable advantage of this approach the feedback of the Portal users can be considered in the following second step, when extending the prototype to the final GGOS Portal comprising all requested features.



**Figure 2 GGOS system design, directing users through the portal to underlying data, products and information. However, the GGOS Portal will be a unique access point for the users, the portal will also provide a route to the heterogeneous IAG service/technique specific information systems.**

In general existing information from other Web sites, e.g. IAG services, won't be duplicated within the GGOS Portal but presented as external link. Moreover, the topic ordered link collection of the GGOS Portal will offer a structured overview with respect to all information and data related to GGOS. Also existing metadata catalogues will be embedded as far as their hosting institutions are already offering CSW interfaces or are willing to provide them.

## 3.2 Work

### 3.2.1 First Step – GGOS Portal Prototype

#### GGOS Web site

The Web site will be built using existing hardware and software resources at BKG, i.e. the CMS "Government Site Builder" will be used. Thus, the Web pages can be created without preceding soft- or hardware installations and adoptions right from the start. The following features of the Web site can be realized with the standard GSB tools as soon as the information is at hand:

- Basic functionalities, hot spot information, news, tutorials, quick links, announcements, etc.

- General information on and explanations of data, products and geodetic techniques, with directions to service-specific resources.
- Calendars, presentations, meeting summaries, working group activities standard GSB tools.

All Web pages will be updated continuously.

To realize a bibliography the existing IAG service GEOPHOKA maintained at BKG will be investigated for a seamless integration within the GGOS Web site. If not appropriate, a solution will be explored during the second step in conjunction with the realization of user forums and mailing lists.

### **Clearinghouse**

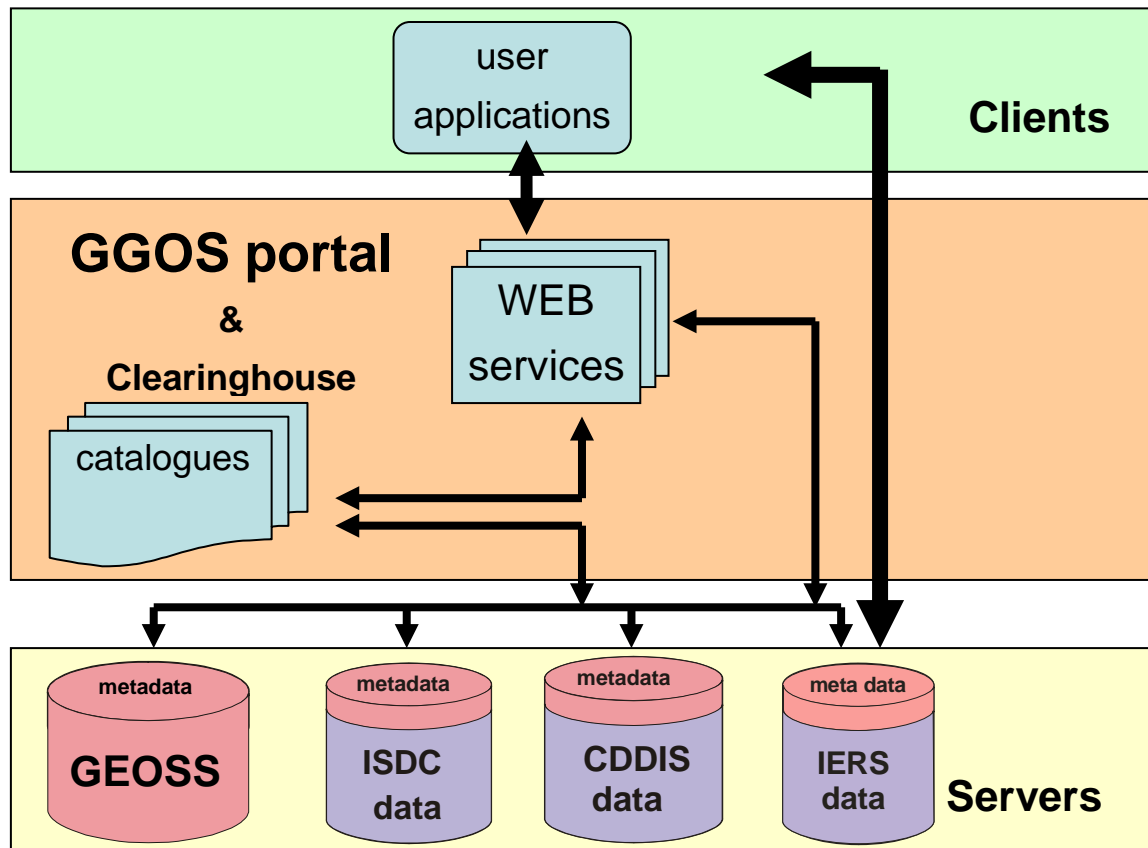
The metadata catalogues within the GGOS Portal will be based on the IERS metadata database and the ISO 19115 compliant metadata profile developed in GGOS-D. This profile will be further extended and adapted to create the GGOS metadata profile appropriate for all products of the IAG services relevant to GGOS. The profile will be mapped to an XML Schema, defining the format the product metadata have to match. GGOS data providers should deliver XML files with metadata that can be validated against this XML Schema. The profile will also be mapped to a database schema based on the IERS metadata database. Standard XML parsers will be used to read the metadata files and to import the metadata into the database. Example XML metadata files for IERS products will be provided in order to support the data providers when preparing XML metadata files for their products.

The metadata to be held by the clearinghouse depends on the approach used for searching. Two anticipated capabilities for access to remote catalogues (see Figure 3) may include:

- Distributed search approach: search requests are sent in parallel to registered distributed catalogues of the IAG services.
- Harvested approach: The clearinghouse periodically harvests all metadata from registered distributed catalogues. A user search request is executed against the metadata harvested from the remote catalogues and the results are managed and portrayed in the GGOS Clearinghouse.

The metadata search and the user interface will be realized by a clone of the respective components within GeoPortal.Bund. As far as their providers are willing to cooperate, other metadata databases like e.g. the *Global Change Master Directory* (GCMD) may be connected via a Catalogue Service Web (CSW) interface in order to ensure interoperability. Therefore the CSW implementation from the GeoPortal.Bund will be

cloned, too, as well its Web Map Service, called Geoviewer, for map visualizations of the data.



**Figure 3 Metadata approach by GGOS Portal**

An ISO registry of contributing services and institutions within GGOS will be developed, based on the experiences gained in conjunction with the development of an ISO register for geodetic codes and parameters.

### **Applications**

The GGOS Portal will be complemented by distributed applications for data mining. At first a comprehensive collection of links to applications available at the various IAG services or at other institutions will be provided. However, the goal for the final GGOS Portal shall be to seamlessly integrate as much applications as possible.

As a first step applications based on standard techniques and developed at BKG will be integrated into the GGOS Web site. Additionally, these applications should be available also within the environments of the GGOS users. Typical applications are the interactive data analysis tool of the IERS and the Coordinate Transformation Service (CTS) of the *GeoDatenZentrum*. Both applications are available as Java applet versions and can be integrated seamlessly into the GGOS Web site. Moreover the CTS offers a Web Service Interface and the data analysis tool is available also as Java Web Start application, i.e.

both applications can be easily used within the users environments.

Another excellent example for this is the Geoviewer of the GeoPortal.Bund. This application is based on a standardized Web Map Service allowing the users to integrate map layers from any map provider supporting the WMS standard. Moreover, the Geoviewer is available as server based Java applet version and as client based Java Web Start version.

### **3.2.2 Second Step – GGOS Portal Final**

The final GGOS Portal will emanate from the prototype GGOS Portal, i.e. some parts will be further developed and improved, some parts will be substituted and missing features will be included into the Portal.

#### **GGOS Web site**

Unlike the prototype GGOS Portal the final GGOS Portal will be run on GGOS dedicated hardware using a GSB installation only used for the GGOS Portal in order to be independent from other Web sites maintained at BKG.

Missing features of the GGOS Web site will be complemented. If appropriate, the GSB will be used to implement these features. Otherwise Open Source Software will be applied.

#### **Clearinghouse**

In the prototype GGOS Portal the metadata database is related to the IERS metadata database and the interfaces for search, mapping, etc. are based on GeoPortal.Bund components and related Web services. This allows implementing a solution for GGOS at best time. However, this solution is not optimal because of the separation of the database from the interfaces. Therefore professional metadata management software should be used. The software should offer all requested features for clearinghouse and should be customizable to the special GGOS requirements.

In particular, the software has to provide an interface to import XML metadata files in order to be able to include those used in the prototype GGOS Portal. Moreover, a metadata editor must be available allowing straight input of metadata into the metadata database without the need to create a XML metadata file. This is of particular interest for data providers that are not familiar with XML.

#### **Applications**

The final GGOS Portal shall provide a comprehensive collection of distributed applications.

Starting from the link collection and the integrated applications within the prototype GGOS Portal the gathered applications will be investigated with respect to the possibility for a seamless integration into the GGOS Web site. This will be done in close cooperation with the institutions providing these applications. BKG is actively involved in several IAG services and thus contacts to most institutions are at hand.

### **3.3 Schedule**

As described above the proposed schedule (see Fig. 4, following page) is divided into two parts: the development and implementation of the prototype GGOS Portal and the final GGOS Portal. The intention is to provide in the first step a preliminary but fully operational system being refined and complemented by all necessary components in the second step. Right from the start there will be a continuous support of contributing institutions to set up metadata. To formalize this important step templates and a specific metadata editor will be developed which is adopted to the heterogeneous data within the GGOS community.

However, providing the technical tools and background the success and progress to realize the GGOS Portal is strongly depending on the active participation of the IAG services contributing the products and information.

## Time Schedule

### GGOS Web site:

Design and navigation structure  
 Create Web pages: news, quick links, announcements, ...  
 GSB installation on GGOS dedicated hardware:  
 Web site migration to new GSB installation:  
 Implementation of missing features (user forums, etc.)

### Clearing house:

Create GGOS ISO 19115 metadata profile and XML-Schema:  
 Map metadata profile into database:  
 XML metadata parser for metadata import into database:  
 Clone GeoPortal.Bund components:  
 Connect external metadata catalogues via CSW:  
 Create registry of contributing services and institutions  
 Develop and distributed template for meta data management:  
 Installation of professional metadata management tool:  
 XML metadata file import:  
 Adaption and further development of metadata management tool:

### Distributed Applications for data mining:

Create link collection of available applications:  
 Seamless integration of applications from BKG and IERS:  
 Seamless integration of available applications within IAG:

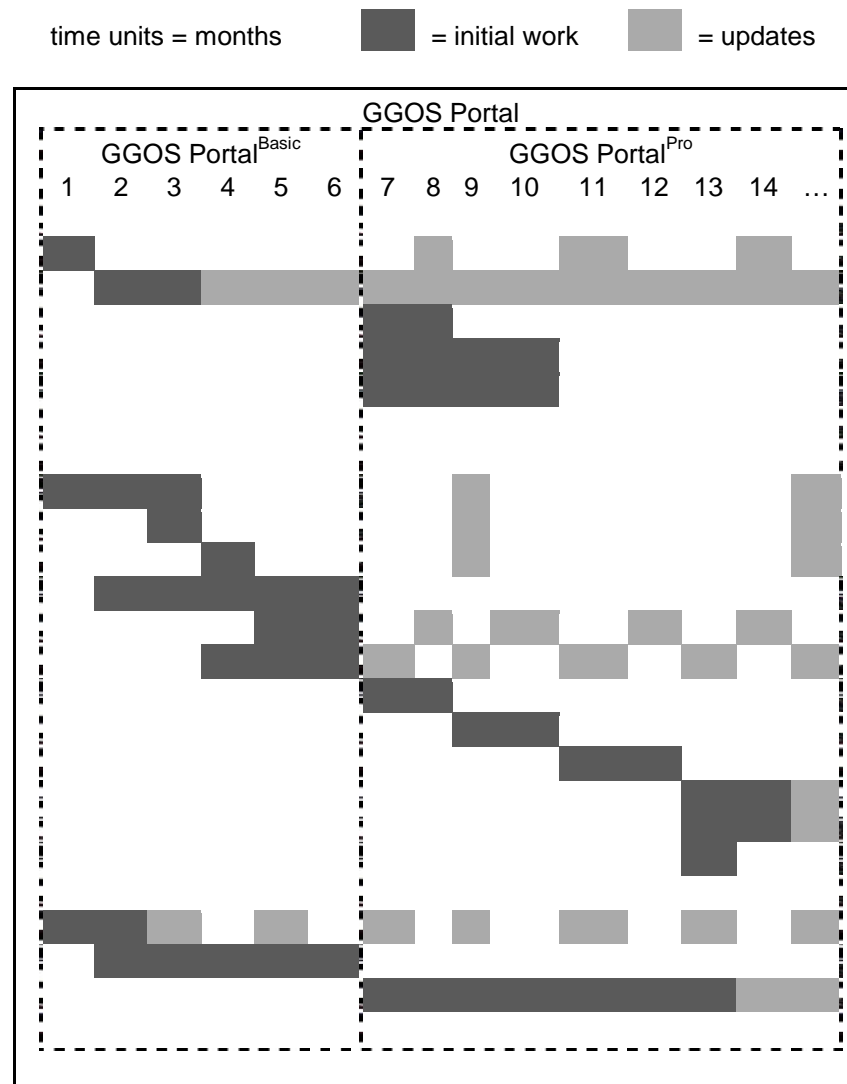


Figure 4 Schedule for the implementation of the GGOS Portal

### 3.4 Management Structure and Staff Plan

The Portal activities will be included into the BKG organization within the Department of Geodesy, section "Global Reference Frames" currently dealing with SLR and VLBI data analysis and handling as well as the IERS Central Bureau. A special project group dedicated to the Portal will be established. However, the establishment and the maintenance of the GGOS Portal are positively affected by the synergy effect coming from the IERS Data and Information System (IERS DIS).

The GGOS Portal implementation and maintenance will be performed by two full staff members (1 scientist – Ms. A. Kreutzmann, 1 engineer – Mr. A. Lothhammer) supported by 2 full staff members (1 scientist – Dr. Schwegmann 50% / Dr. Dick 50%, 1 engineer – Ms. S. Schneider) from the IERS DIS. The qualification of the staff is in the field of Geodesy, Geophysics and Informatics.

The GGOS Portal manager will be Dr. Wolfgang Schwegmann supported by Dr. Bernd Richter, director of the IERS Central Bureau.

The work will be supported also by experienced staff members with scientific and technical background from the Geodetic Department. Primary contributors will be

- Dr. Habrich experienced in GPS by running a IGS regional data center, the EUREF Analysis Center and GPS/GLONASS data analysis at BKG.
- Dr. Thorandt, Mr. Engelhard, and Dr. Hase from the VLBI group, experienced in the VLBI observation, data center, VLBI analysis and VLBI combination in the IVS.
- Dr. Mareyen from the SLR group, experienced in SLR-data analysis and the ILRS.
- Dr. Wzointek as expert in gravity and the gravity data base.

For the GGOS Portal the existing infrastructure at BKG as described in Section 2 can be used. BKG is member of the German Research Network (DFN) and all its branches are connected to the German Scientific Network (B-WIN) with a capacity of 2Gigabit/s. Within BKG a powerful LAN Intranet connects all workstations with transfer rates of 100 Mbit/s. Presently more than 30 workstations and servers with HP-UX or LINUX are operated in the geodetic department where the GGOS portal environment can easily be incorporated.



### 3.5 Financial Arrangements

Financial resources will be made available from the BKG budget. Aside the costs for the staff BKG is willing to invest as much as necessary up to 100.000 Euro/year for the technical equipment such as computer facilities and software development.

BKG is readily available to collaborate with other institutions to improve the functionality, quality and interoperability of the GGOS Portal.

Frankfurt, November 7, 2008



(Univ.-Prof. Dr.-Ing. D. Grünreich, President and Professor of BKG)