

Concept of Operations Document GEOSS Common Infrastructure

DOCUMENT OVERVIEW

“The vision for GEOSS is to realize a future wherein decisions and actions for the benefit of humankind are informed by coordinated, comprehensive and sustained Earth observations and information.” To achieve this vision and stimulate broad use of GEOSS, the system of systems must provide ready access and improved interoperability for existing and future observation systems. The tools for access and interoperability are the core elements of the “Common Infrastructure” of GEOSS (GCI). These include ways through the web to identify and access services available. It also includes a list of interoperability agreements and best practices that ultimately allow users to employ global data sets without having to translate data from different national and regional systems.

To build this system, a series of user-based requirements define the essential operating framework. An operations structure (the Initial Operating Capability) is then developed. Finally, the steps for users to employ this GEOSS structure must be described and evaluated. This Concept of Operations Document addresses the last step, building upon the current capabilities of the 2008 Initial Operating Capability.

This Concept of Operations is a “high level” system document that is used to build consensus among both user groups, and developers so that there is a common technical understanding of the requirements and functionality of the GEOSS. The document thus includes a system description, a description of different types of users, the ways in which these users will employ GEOSS and an examination of operational scenarios. Ultimately, it is these and similar scenarios which will provide the process to test the performance of the GCI.

This document is the first of four documents to be prepared by the IOC Task Force. Building on the high-level concepts of this document, a Consolidated Requirements report, an Evaluation Report, and a Recommendations Report will be developed to assist in understanding and advising the operations of GEOSS and the GCI.

1 SCOPE

This Concept of Operations document describes the capabilities of the Global Earth Observation System of Systems (GEOSS) Common Infrastructure (GCI). This common infrastructure includes the core components and functions that link the various resources of GEOSS together. The GCI consists of web-based portals, a clearinghouse for searching data, information and services, and registries containing information about GEOSS components, standards, and best practices.

2 REFERENCES

2.1 References

[ADC 2007a] Tactical Guidance for Current and Potential Contributors to GEOSS, October 8, 2007, ftp://ftp.wmo.int/Projects/GEO/ADC/Public/ADC_Guidance_Docs/Tactical_Guidance_Oct08.doc

[ADC 2007b] Strategic Guidance Document for Current and Potential Contributors to GEOSS, October 2007, ftp://ftp.wmo.int/Projects/GEO/ADC/Public/ADC_Guidance_Docs/Strategic%20Guidance%20Document_071010.pdf

[GEO2007] GEO Work Plan, 2007-2009.
http://www.earthobservations.org/documents/wp0709_v6.pdf

[GEO2008] “The GEOSS Common Infrastructure Establishment Process Document,” GEO Secretariat, March 2008

[GEOSS 2005] The Global Earth Observation System of Systems (GEOSS) 10-Year Implementation Plan, as *adopted 16 February 2005*,
<http://www.earthobservations.org/documents/10-Year%20Implementation%20Plan.pdf>

2.2 Acronyms

GEO – Group on Earth Observation

GEOSS - Global Earth Observation System of Systems

GCI – GEOSS Common Infrastructure

IOC – Initial Operating Capability

SBA – Societal Benefit Area(s)

SIR – Standards and Interoperability Registry

Definitions of the major elements of GCI are provided in Annex 1.

3 DESCRIPTION OF DESIRED CAPABILITIES

As suggested in the 10-year implementation plan, a built-out GEOSS requires the following common capabilities to provide adequate functionality:

- Registration of offered GEOSS resources (components, services, and data), standards and “special arrangements,” user requirements, and best practices. The registries should allow easy submission of offered components and services and support standard search protocols and metadata formats to promote interoperability and integration.
- Standardized search (GEOSS Clearinghouse) across registered items and metadata catalogues to promote rapid access to inventory-level information about offered components, services,

and data. Other resource types may be registered with GEOSS catalogues, including, but not limited to, software applications, training materials and courses, web sites/portals, news feeds/RSS, models, and documents.

- Primary user interface (GEO Web portal) to discover and access registered resources of interest for the GEO community at-large and potentially for specific communities of interest. Interaction goals for the portal(s) include the ability to allow to search, discover and access to all GEOSS resources through a single user interface with minimal user interaction (“fewest clicks to content”) to connect to services and information through well-documented interfaces offered by GEO Members and Participating Organizations

Figure 1 depicts the enhanced capabilities in an operational view diagram. The contribution of resources related to earth observing systems are primarily data and services, and their descriptions (metadata). The central portion of the diagram shows the GEOSS Common Infrastructure that coordinates access to the systems, applications, models, and products. Users are shown in the context of the nine official GEO SBAs.

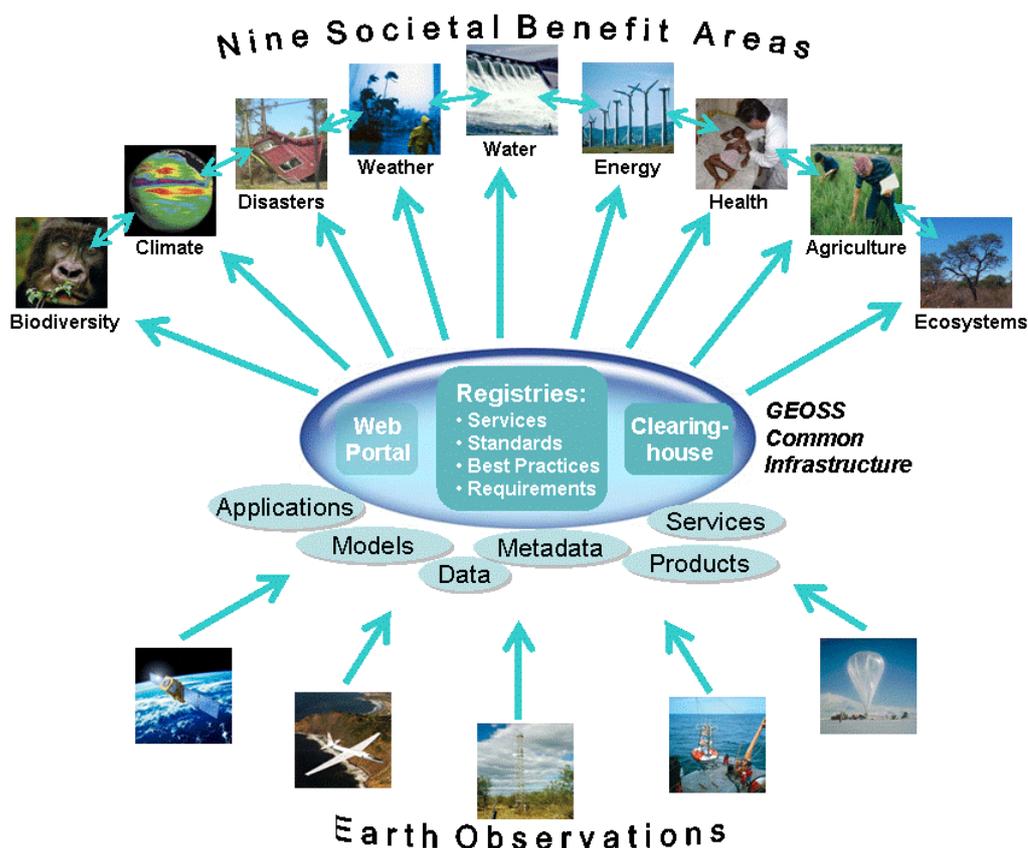


Figure 1 – Conceptual operational view diagram of the GEOSS Common Infrastructure (GCI) and its relationship to observations and end-users (SBAs)

4 CONCEPTS FOR THE GEOSS COMMON INFRASTRUCTURE

This section of the ConOps document details the general operating environment and notional capabilities of the existing GEOSS Common Infrastructure (GCI) and its interaction with external users and resources.

4.1 Background, objectives and scope

The GCI has the goal to allow satisfying the objectives defined in the GEOSS 10-year implementation plan through the deployment of several components operated on behalf of the GEO community. The primary effect of the GCI – the operational aspect of GEOSS – is to register and publicize the offered resources from the GEO community, encourage and support interoperability and to facilitate their discovery, access and utilization by end-users.

Two key resources available through the GCI are “Components” and “Services.” A "GEOSS Component" is one of many earth observation resources that are contributed by a GEO Member or Participating organization. Example types of contributed Components include observing systems, data sets and products, catalogues, websites, models, training materials, or initiatives. Where appropriate, registered service interfaces can be defined and linked to a Component.

A "GEOSS Service" describes a service interface to a component resource. Typically implemented as an Internet-accessible resource, these service interfaces promote the exchange of structured messages for the selection or processing of information. Each implemented service interface may be associated with one or more GEOSS-registered standards to promote interoperability; these linkages identify the standard service protocol, data or metadata format, schema, and other criteria that will allow client software to use it.

The GCI includes three major capabilities that will be detailed in later sections:

- registries of GEOSS components, services, standards, requirements, and best practices,
- a common search facility, known as the GEOSS Clearinghouse, that simplifies search across all offered and registered resources, and
- a web portal that provides human users a “one stop” access to all GEOSS resources

The scope of the GCI is limited to the functions of the registries, clearinghouse, and web portal and their interaction with external users and resources. The internal or “native” behavior of external systems is beyond the scope of either GEOSS or the GCI. External (public-facing) systems are expected only to expose documented, ideally standardized, service interfaces.

4.2 Operational policies and constraints

The GCI operates within the context of voluntary contribution of components, as described in the 10-year implementation plan. All the identified registries are being contributed and operated by Members and Participating Organizations. The linking of the registries, where appropriate, is being accomplished through pair-wise discussion and implementation. The operation of the three Web Portal and Clearinghouse candidates has been offered by a mixture of commercial, governmental and international organizations. As these common capabilities are fundamental to the success of GEOSS, the interruption of service caused by an offeror’s withdrawal could be damaging to the operation and usability of GEOSS if no adequate measures are taken to mitigate the disruption. Intentional redundancy of GCI component operations is intended to address this issue of critical availability. The development of a commitment framework for a GCI service level agreement or service quality assertions and transition planning requirements would help to mitigate such potential disruption of GEOSS service access.

Quality review of registry content is a recognized need and responsibility that should be addressed by the GEO community and the GCI component operators. Non-GEO members may register/offer resources that would be so identified in searches of the Component and Service Registry.

The Standards and Interoperability Forum (SIF) was established to provide an oversight group to the accession of formal external standards and less formal but shared practices, known in GEOSS as “special arrangements,” into the Standards and Interoperability Registry. This group meets regularly to discuss and approve candidate external standards and practices in the registry where they are documented and named in a consistent way to promote re-use throughout GEOSS. They also work with users to facilitate the understanding and use of standards within GEOSS.

4.3 Description of the GCI

The GCI operates in the context of external users and providing access to their offered resources, as shown in Figure 2. This figure builds upon the minimal detail of Figure 1, and identifies the interactions within the GCI and external resources. The arrows in the diagram do not represent information flow, but rather are intended to indicate the direction of reading the relationship between each of the two linked objects. The primary resources ‘outside’ of the common infrastructure are the web sites, services, data, and portals operated by GEO Members and Participating Organizations. *Registered Components and Resources* represent the offered component systems and their services registered with GEOSS. *Unregistered Community Resources* denotes a number of other less-structured resources that may be of supplemental interest to end-users, and may be presented as links from a Web Portal to supplement GEOSS services and data. Newsfeeds (RSS), documents, and other web sites are examples of such unregistered resources. Wherever possible, however, resources should be identified as services (or component systems with related web sites) and be registered directly with GEOSS. Registration allows for the same base of known information to be available to all GEOSS client software and Web Portal implementations.

The GCI is shown as being enclosed by a light green oval. Within the oval are the identified registries, the GEO Web Portal(s), and the GEOSS Clearinghouse(s). Key external interactions are with users, offered GEOSS registered resources (services, component systems, etc.), the GEONETCast satellite data broadcast service and other communication services, community resources not registered with GEOSS, and the main GEO web site. The specific interactions of a publisher-user are not shown in this figure. Each of the capabilities shown as boxes in the diagram is explained below. Key capabilities and definitions of the GCI elements are provided in Annex 1.

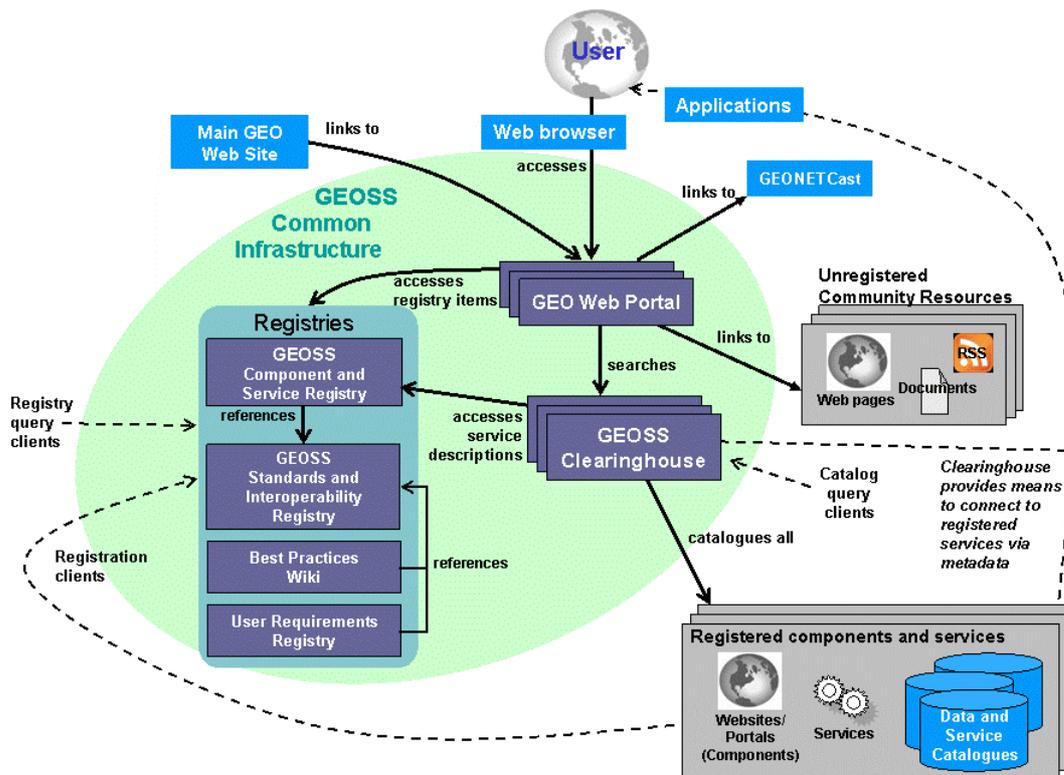


Figure 2 – An object-interaction diagram depicting the major relationships between the GCI component services and selected external resources. (Modified from GEO Secretariat “The GEOSS Common Infrastructure Establishment Process Document” March 2008)

The GEOSS Registries are shown grouped in this diagram as they have similar behaviors and interaction with other parts of GEOSS – they expose standardized registration and query interfaces and perform a “yellow pages” role in managing high-level access to GEOSS resources. All the registries are used as a place to store and publicize (register) items that should be visible in GEOSS. In essence, if an item is in a Registry, it is a recognized part of GEOSS.

GEOSS Standards and Interoperability Registry is used to register and share standards and special arrangements nominated by GEO Members and Participating Organizations. Users may nominate standards or special arrangements to be included in this registry through a nomination form (registration client). Each standard or special arrangement is given a name, a unique identifier, a description, and is classified by type of standard. These items are reviewed for inclusion by the Standards and Interoperability Forum (SIF). The SIF is a group of domain experts who are convened to adjudicate the addition of standards and special arrangements, helping to avoid duplicate, incomplete, or irrelevant entries. This structured approach lets other parts of the GCI (and even external users) re-use a current list of recognized standards. This registry is explicitly referenced by the Best Practices Wiki, the User Requirements Registry, and the Component and Service Registry.

The Component and Service Registry provides the key “yellow pages” feature of GEOSS, allowing GEO Members and Participating Organizations to identify and describe GEOSS Components and Services associated with them. Each registered component may be associated with one or more service interfaces that are available to provide access to Earth Observation data, modeling, or other

processing. When registering a service, the offeror is invited to identify and link to already existing standards or special arrangements, or is invited to nominate one through a re-usable entry form.

The Best Practices Wiki is a less-structured form of registry that allows GEO Members and Participating Organizations to share common techniques. It is intended that this wiki would be used to publicize techniques used in the GEOSS or in specific SBAs that would be of use to others, both for outreach and for common adoption of preferred approaches. The Wiki incorporates a broad range of practices addressing observation, information products, training, capacity building and others. Where standards are mentioned, a link will be made to the Standards and Interoperability Registry to provide additional information.

The User Requirements Registry consolidates requirements for Earth Observations – what is to be measured, how often, where, to what resolution, to what accuracy, in what units of measure – based on a series of user types. A structured vocabulary of named observation parameters will provide a means to compare registered existing and planned observations with requirements and identify gaps and availability of coverage.

The GEOSS Clearinghouse provides search across all component and service descriptions that are in the Component and Service Registry. A small set of searchable fields is extracted from the descriptions and are made available through a standard query interface to support rapid and consistent search across multiple community catalogues. Registered catalog services are, in turn, queried and their contents are either harvested on a recurrent basis or are searched in parallel. Applications may also query the Clearinghouse to discover and access services through links stored in the service descriptions (metadata).

The GEO Web Portal is the centerpiece for access to, search, discover and access GEOSS resources. Through a series of standards-based software interfaces, the web portal interface allows a general user with a Web browser to:

- search for systems, initiatives, and programs against the GEOSS Component and Service Registry,
- link to and search registered standards, best practices, requirements (and vocabulary) in those respective registries,
- view information in the context of specific SBAs while supporting cross-domain and domain-specific perspectives,
- perform a GEOSS-wide search for services, data, and other resources (including the GEONETCast broadcast schedule) that are catalogued through the GEOSS Clearinghouse,
- display and organize linkages to ancillary documents, feeds, and web resources not otherwise catalogued in GEOSS,
- visualize geo-enabled RSS feeds using a globe for navigation,
- display map and imagery sources discovered through standards-based service interfaces found for registered services, and to
- optionally, identify or launch ‘helper’ portal-side portlets or desktop applications to perform further analysis on found data and services.

The GEO Web Portal is specified as a portal environment that will 1) provide a single, official ‘front door’ to GEOSS as linked from the GEO Web site, and 2) allow for deployment of additional GEO Community Web portal instances for SBAs and GEO Members and Participating Organizations to customize for more focused areas of application. Both deployments – GEO-wide and topic-specific – would still provide access to the richness of the GEOSS resources documented elsewhere in and around the GCI in Figure 2. Additional characteristics of GEO Web Portals are given in Annex 1.

4.4 Modes of operation

The primary modes of operation affecting the GCI in terms of information flow include service/data creation, registration, approval, discovery, and access. These are described in the following general flow events:

- The GCI relies on the (GEO Member and Participating Organization-owned) creation of data and services in the context of Earth Observation systems.
- Data and services are described in sufficient detail to support discovery and to help match user application requirements.
- Descriptions (metadata) of EO systems and programmes are entered into the GEOSS Component Registry or are stored in member catalogues.
- One or more service descriptions are associated with a registered component in the Component and Service Registry.
- Standards are nominated for inclusion in the Standards and Interoperability Registry.
- Once approved by the Standards and Interoperability Forum, nominated standards are visible for GEOSS registry users.
- A service description can be linked to one or more standards or special arrangements to promote interoperability. These may include reference to service, protocol, format, schema, or other registered standards or special arrangements.
- GEO Secretariat validates/approves Component/Service entries making them visible to the public.
- Catalogues (of data and services) are registered as services in the Service Registry and, where standard interfaces exist, their contents are then made accessible to the Clearinghouse search facility.
- Best practices are documented in a Wiki format in the Best Practices Wiki and may be linked to relevant standards, registered services, and data references.
- User requirements are entered by form into the User Requirements Registry or are batch uploaded from external requirements databases. Requirements should link to a standard vocabulary of observable/derivable/measurable and related quality parameters (resolution, precision, frequency, accuracy, etc.) to be shared across GEOSS.
- Users approach GEOSS through the Web Portal interface allowing to search, discover and access EO relevant information and services either internal or external to GEOSS. Search can be performed by SBA categories, by geographical location on a globe and, for registered components, through the registries and clearinghouse.
- The Web Portal provides in particular the following services:
 - Geospatial Portal Service providing the user interfaces for viewing, discovering data, information and services available in GEOSS.
 - Portrayal Viewer Service allowing the display and handling of maps and context information from various sources, e.g. from different GEO Societal Benefit Areas through mapping services.
 - Interfaces to Catalogue Services of the GEOSS Clearinghouse, allowing distributed catalogue search in an interoperable manner.
 - Browse through a comprehensive directory of service providers e.g. related to GEO Members and Participating Organizations.

- Retrieval of Earth observation education, training and capacity building resources.
- Metadata records stored in remote catalogues are periodically accessed by the Clearinghouse and subset set of fields is stored to provide rapid access to trans-GEOSS holdings.
- Search is performed on the Clearinghouse through a web form hosted in the Web Portal, the query is either distributed to remote catalogues or to a cached subset of metadata in the Clearinghouse. Search results are sorted and returned for presentation to the Web Portal client as minimal metadata with links back to the original metadata and to the resource being described.
- Where Clearinghouse or Registry metadata includes a recognizable, standard interface URL or format, the Web Portal should render the data or services in an appropriate fashion for further visualization.

The provided flow elements are given as examples only and are not intended to be exhaustive of the process and decision-making within the GEOSS Common Infrastructure and external process.

4.5 User types

Publisher – Individual(s) authorized by Member and Participating Organizations to commit GEOSS Components and/or Services

Operator – The agency/organization responsible for the operation and maintenance of a committed service and related data

Approver – Acts to approve or disapprove an entry or update in one of the GEOSS Registries and the GEO Web Portals. In the case of the Component and Service Registry, the GEO Secretariat processes entries and approves them if they are offered by Member and Participating Organization. The Standards and Interoperability Forum (SIF) members approve entries in the Standards and Interoperability Registry. Other approvers affiliated with each offering are anticipated to approve contributions/changes to the Best Practices Wiki, User Requirements Registry, and the GEO Web Portals.

Software and services integrator (Integrator)– A class of user typically engaged in support of one or more application areas who is able to use GEOSS to locate suitable services, data, and related resources, and to develop and deploy integrating software solutions that cater to a specific context or subject area. These users identify suitable data, standards, and services from the Clearinghouse and Registries, and connect end-user applications (Web-based or desktop) to these services and data as part of decision support workflow.

GEOSS-Experienced users – Users who understand the concepts of GEOSS and seek registered resources through the GEO Web Portal interface or desktop applications. This type of user will use the GCI to find, evaluate, and access GEO resources relative to topical, geographic, and temporal interests and then be linked to external applications, invited to download data, or connect to a service in support of their problem domain.

Issue-Oriented Users - Researchers and science-to-policy analysts who work on specific issues that fall within one or more Societal Benefit Areas. They are not GEOSS-experienced but are looking for any and all observational data and services that are relevant to their specific issue relative to geographic or temporal constraints. The GEO Web Portals facilitate access to the community or SBA and support navigation of organized resources available to them. They use topical, spatial, and temporal navigation capabilities behind the GEO Web Portals and Clearinghouse that let them easily explore and overlay the relevant data sets on maps and receive charts, pictures, and documents that have been organized to show the latest finding from GEOSS in their area of interest. As their understanding of GEOSS improves, this class of user will be able to perform more sophisticated interactions with the GCI through the GEO Web Portals, including registration of resources, providing

user requirements, contributing to SBA focused areas, and contributing Best Practices. GEOSS could gain considerable positive feedback in the public domain from these users.

4.6 Support environment

Given the voluntary nature of the GEO process, all operational support activities have been volunteered by Member and Participating Organization entities, as follows:

- Component and Services Registry (United States)
- Standards and Interoperability Registry (IEEE)
- User requirements Registry (United States)
- Best Practices Wiki (IEEE)
- Web Portal (Compusult, European Space Agency – Food and Agricultural Organization, ESRI)
- Clearinghouse (Compusult, ESA, ESRI, United States - USGS)

At this point in time, there are three offers for Web Portal and four for Clearinghouse solutions as candidates. Part of a commissioned GEOSS Initial Operating Capability Task Force effort will be to identify the need for and recognition of one or multiple ‘official’ GCI components where multiple are offered.

5 OPERATIONAL SCENARIOS

This section contains brief narratives of interaction and process flow associated with a series of common tasks that exercise portions of the GCI.

5.1 Registration of GEO Components and Services

An individual (Publisher) who is affiliated with a GEO Member or Participating Organization goes to the GEO Web Portal and is then linked to the GEOSS Component and Service Registry. Information about their Earth Observation initiative/program is entered as metadata into an online web form, as is the URL to the initiative offerors website. While being entered, the Component is classified by the SBAs it primarily supports, its type (activities), and the timeframe of information availability. The GEO Secretariat receives notification that a pending Component has been registered and validates the registration based on the status of the registering individual and the quality of the registry entry.

For each given offered Component, one or more service interfaces may be registered. Each service is described and linked to an existing standard or special arrangement in the Standards and Interoperability Register. If a sought standard or special arrangement is not present, the user is allowed to nominate one or more through a web form in common with in the Standards and Interoperability Register.

5.2 Identification of relevant GEOSS standards

An individual (GEOSS-Experienced User) from a specific scientific or professional background wishes to promote the recognition of their standard or special arrangement within the GEO community. Standards and special arrangements together are known as *interoperability arrangements*. Users connect to the Standards and Interoperability Registry (SIR), either directly or, more probably, through a link on the GEO Web Portal, to see what interoperability arrangements are registered, browsing by category of standard. If the interoperability arrangement they are interested in is present they can apply it when they register services they wish to publish with GEOSS. If the interoperability arrangement is not listed, they can nominate basic information about it and its maintenance organization into the SIR.

The Standards and Interoperability Forum (SIF) (Approver) convenes regular meetings (primarily through teleconferences) to process nominations. If a newly nominated standard comes from a recognized standards development and maintenance organization, the submitted information is verified and it is advanced as a registered standard in the SIR if it is not already in the SIR by another name or variant. If the nomination describes a more informal community practice that is likely to be applied by more than one organization, then it is advanced as a “special arrangement” once the submitted information is verified. The results of either process are made immediately available for other Registries and applications to consume via a web service.

5.3 Discovery of resources registered with GEOSS

A prospective GEOSS-experienced user with a decision support issue seeks a particular type of Earth Observation data for a specific geographic and temporal coverage. The user connects to the GEO Web Portal to begin the search by first browsing information about the registered component systems and their associated services. The user also investigates news feeds and documents that are linked from the portal for the latest information on the scenario or phenomena they are supporting. Links to browse or search on the User Requirements and Best Practices (Wiki) Registries should also be provided by the Web Portal to provide additional contextual information to the user on the topic of interest.

Search for data and related services is done through a search form on the Web Portal that allows them to search the Clearinghouse based on natural language “simple” search as well as more advanced search on text and selected fields that include location, temporal coverage, and some classifications. Browsing for resources may also be accomplished through use of agreed common classification schemes for SBAs, standards, document types (reports, best practices, capacity-building educational materials, etc.). Brief results are returned displaying the title, description, and type of the item found. These results can be grouped or sorted in various ways. The user can click on the result links to obtain more detailed descriptions (metadata) or connect directly to the resource being described. Some types of results can be visualized as familiar files with ‘helper’ software already installed on their desktop computers or through viewer/browsers optionally identified by the GEO Web Portals and Community Web Portals.

Software and services integrators may embed catalog and other protocol clients into their decision-support or web application software to provide direct search of the Registries or Clearinghouse and obviate the need for using the Web Portal for primary discovery. Thus, the end-user can run their preferred application environment and still be able to perform search on GEOSS and apply/integrate the results without having to leave the application.

A second case of discovery is that of resources registered with GEOSS based on requirement for SBA issue-oriented data/information within a geographic area of interest.

A prospective, less-GEOSS-experienced, user with a decision support issue does not know what particular type of Earth Observation data to seek but is looking for any and all observational data and services that are relevant to their specific issue and/or specific geographical region. They initially look at the sections of the portal that allow one to choose a Societal Benefit Area or perhaps more than one SBA to pre-designate a future search. They also look for drop down menus of issues within the SBAs which would give more specificity to the search parameters. When the user is finished searching, he/she is directed to news feeds and documents that are linked from the portal for the latest information on the scenario or phenomena they are supporting. The user is encouraged to peruse a searched-set of this information that the Portal automatically provides to identify additional key words related to their issue. The Portal does an initial search for data and information relevant to the issue and may display certain references or geographically, or in graphs and charts.

Ideally, the data that is found by the user should include source metadata to assist in understanding of its origins, access conditions and help evaluate its fitness for a specific use. The Portal may also provide information on how the inexperienced user can get further assistance from experienced service providers through links to the Best Practices Registry or to educational documentation.

5.4 Identifying best practices

A professional interested in publicizing a recognized methodology to the GEO community to encourage understanding and uptake connects to the GEO Web Portal and is directed to the Best Practices Wiki. Once they login, they are able to compose a lightly structured narrative of the practice, linking to GEOSS-registered standards and special arrangements and external references where they may exist. Using the Wiki environment, other individuals may comment on and add to the practice and examples, with consent of the author and the managers. An editorial team reviews inputs for relevance to GEOSS.

5.5 Defining EO user requirements, coverage, and gaps

User Engagement - Through "User Engagement" of different non-GEOSS-Experienced users groups when they are interested in learning about GEOSS, the User Interface Committee is capturing information about user types, user applications (from advancing science to decision-support), and user requirements. The goal in each user engagement is to get clear and concise answers to the following questions:

- who are the users (that are being engaged)?
- what data/information/services do they use? (Note: this will include observational and non-observational data)
- how do they use the data/information/services? (This gives insight to the applications and/or decision-making)
- what additional data/information/services do they need to do their job better?

The next step is to translate these user needs into the user requirements for Earth observations – i.e. what is being measured, how often, where, to what resolution, to what accuracy, in what units of measure, what information available, what forecast and/or decision support systems – based on a series of user types that would be consolidated in the User Requirements Registry. If such user requirements already exist in the registry then a linkage is made that connects the user type and user application to the requirements which can be documented in a Knowledge Base and used in the Portal to help the inexperienced users.

The linkage of the application-specific user needs to GEOSS-specific user requirements is a "value chain" that for the different SBAs and their issues provides GEOSS Members with knowledge as to how to transform observational data and earth system modeling results in "useful information" for applications and decisions that will influence societal benefits.

User Requirements in International Reports - In a number of Societal Benefit Areas, international groups have established scientific workgroups to define the SBA-issue-related user requirements in published reports. These are intended to be extracted and contributed into the User Requirements Registry.

Work Plan Tasks/Communities of Practice - A member of the User Interface Committee, through GEO activities, can identify a set of requirements for a specific SBA that can be generalized to a type or class of user based on the type of information, location, temporal coverage, frequency, precision, units of measure, and discipline of application. Within the GCI, these parameters are entered into the User Requirements Registry and are made searchable through the back-end database. Where possible, interoperability arrangements can be linked to the SIR by a common identifier. The parameter or 'observation type' being described is promoted with a definition, preferably from an ontology or vocabulary already in-use. Where registered data or services also refer to this observation type, a match can be made with existing observations to validate their coverage. Where matches cannot be made between requirements and existing services, then a gap in Earth Observation coverage can be

inferred. The adoption of a common set of vocabulary throughout GEOSS is critical in making this determination.

5.6 Process validation or testing of GCI

The scenarios outlined above should be further scripted to be run and evaluated to assure that end-to-end capability exists and is maintained in the GCI. Anticipated types of testing may include: functionality, performance, suitability, resilience, reliability, responsiveness among others.

Each of the GEOSS Registries and the Clearinghouse expose service interfaces for the ingest of and search for information. The Web Portals expose client interfaces to these other GCI services and may operate services in their own right. Based on the standard interfaces that are supported, basic tests can be run to assure the availability and conformance of the registries as they are deployed. These tests should be run regularly to assure a high level of availability. Fail-over capability should be established for all GCI capabilities in the case of a hardware or network failure.

ANNEX 1: DEFINITIONS OF GCI COMPONENTS

GEO Web Portal (GWP)

- Constitutes a single point of access to information, internal or external to GEOSS, relevant to all SBAs and is of interest to various types of users
- Provides a human user interface to identified content
- Support an all-of-GEOSS search as a Catalog Service for the Web (CSW) client to any GEOSS Clearinghouse instance; formulates query to and processes response from Clearinghouse
- Refers registration of resources to the CSR
- Supports navigation and specialization facilities for SBAs and Communities of Interest
- Supports connection to other GWP or GCP instances through trusted linkages and to other resources of interest for the GEOSS user community

GEO Community Web Portal (GCP)

- A community-focused portal (website) that provides a human user interface to identified content
- May act as a client to its own GEO Community Catalog
- Either:
 - Is associated with its own GEO Community Catalog service (and other services) that are registered with the GEOSS CSR, or
 - Refers registration of its systems and services to the GEOSS CSR
- May include a link to a Clearinghouse search client (or a GEO Web Portal) to encourage search beyond the community

GEO Community Catalog (GCC)

- Collection of community-organized information descriptions (metadata) exposed through standard catalog service interfaces
- Community catalog interface is registered as a service in the CSR
- May be operated in support of a specific GCP

GEOSS Clearinghouse

- Indexes all Component and Service Registry (CSR) entries
- Provides search access to high-level metadata from all catalogs registered in the CSR through remote harvest of metadata or provision of distributed search
- Acts as a CSW client on the CSR
- Acts as a CSW server to GWP, GCP, and application clients

Client application

- Accesses remote data from one or more services and provides manipulation of the data in the client application.
- Decision support functionality may include filtering, aggregation, analysis, visualization, presentation, and interpretation of multiple sources of data.
- May be specific to a user community or may be generic geospatial applications.
- Hosted on the user's computer hardware
- Can be distributed free of charge are desired, note that this does not necessarily require that the code be open source.

GEOSS Component and Service Registry (CSR)

- Provides “yellow pages” listing of all Component (Systems) and Service interfaces that participate in GEOSS
- Systems are classified by one or more SBAs
- One Component (System) may be associated with one or more service interfaces
- Services are associated with one or more standards (or special arrangements) in SIR

GEOSS Standards and Interoperability Registry (SIR)

- Provides list, definitions, and identities of standards and special arrangements (*ad hoc* practices) nominated by members
- Supported by domain and standards experts in SIF

GEOSS Best Practices Wiki

- Provides a GEO-wide posting and comment space for practices within GEO
- Could include methodologies associated with science or with collaborative technology

GEOSS User Requirements Registry

- Database of moderated user types, storing references to application problem needs, and the aspects of “observables” to be matched or to identify gaps in GEOSS coverage