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RECOMMENDATIONS FOR LONG-TERM GCI OPERATIONS
SEPTEMBER 2009

RUSSELL LEFEVRE, IEEE
GEO/STC

GEOSS Common Infrastructure (GCI)
Initial Operating Capability (IOC)

Ivan B. DeLoatch (US)

on behalf of the IOC-Task Force

GEO Committees Plenary
Melbourne, Australia
September 2009

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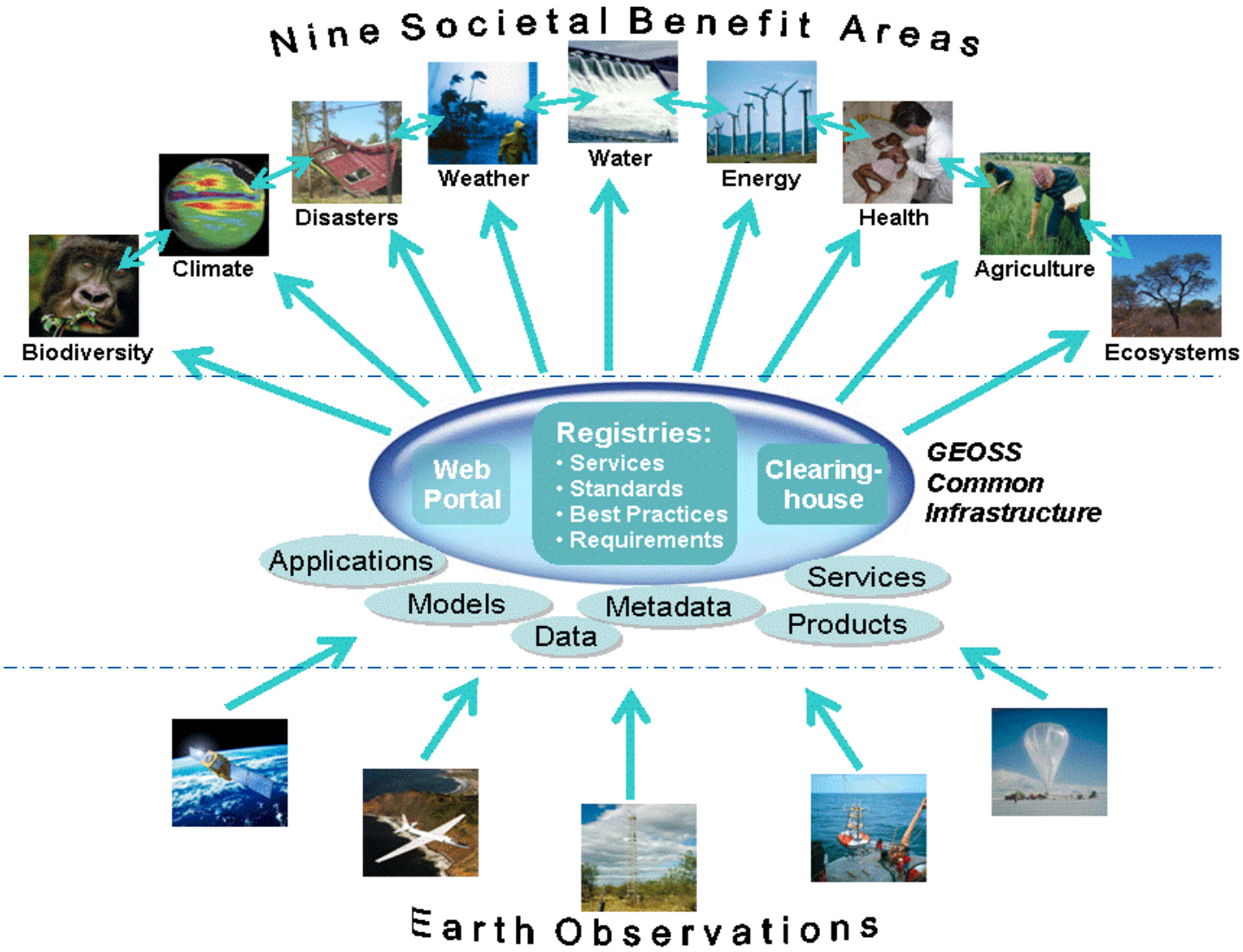
GEOSS Common Infrastructure Operational View



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GEOSS Common Infrastructure (GCI) Strategic Importance

- **Enables GEOSS resources (systems, data and products) to be readily discovered and accessed**
- **Provides improved interoperability for existing and future observation systems.**
- **Delivers trusted data and information**
- **Is "Open", in accordance with the GEOSS Data Sharing Principles.**

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Current GCI Contributors

- **Component and Service Registry (1):**
  USGS/George Mason University (GEO Member)
- **Standards and Interoperability Registry (1):**
  IEEE (GEO PO)
- **Best Practices Wiki (1): IEEE (GEO PO)**
- **GEOSS Clearinghouses (3):**
  Compusult (Private company), ESRI (Private company), , USGS (GEO Member)
- **GEO Web Portals(3):**
  Compusult, ESRI, ESA/FAO (GEO PO)

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IOCTF Deliverables

The IOC Task Force Work Plan, (as amended), identifies the following deliverables:

- **Concept of Operations Document** (**completed** Oct. 2008)
- **Consolidated Requirements Document** **(completed** Mar. 2009)

- **Evaluation & Analysis of Existing GCI Components** (May-September 2009)
  - **GCI Verification Test Plan** – **in progress**; based on Consolidated Requirements
  - **Usability Testing** – first round **completed** based on ISRSE user testing, *second round to be conducted* September 2009
  - **Action Plan** – **completed**: identified issues from usability testing to be resolved by GCI providers

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IOCTF Deliverables

The IOC Task Force Work Plan, (as amended), identifies the following deliverables:

– **Recommendations for long-term GCI operations** (May-November 2009)
  - **Draft recommendations document** (**completed** Sept 2009)
  - **Final recommendations document** (**planned** for GEO-VI Plenary, Nov. 2009)

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Evaluation and Analysis of Existing GCI Components

- First controlled USER testing, (primarily involving remote sensing researchers), took place at the ISRSE-33 Symposium in Stresa, Italy, from 4-8 May
- This was supported by the User Interface Committee and the US EPA, which provided personnel and logistical support for this testing
- 117 tests were performed during this period
- Attendees at the Symposium and the GEO meetings came at random to do the test
- The results were generally positive and provided good, much needed feedback on the many different problems existing in the current version of the GCI

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Evaluation of Existing GCI Components – ISRSE-33

- **117 users** tested the GCI via the GEO Portals: 39 ESRI; 34 Compusult; and 44 ESA/FAO
- **100 (86%)** would visit the GCI again
- **75 (64%)** had not visited the GCI before
- **66 (56%)** previously used Portals or Web sources
- **73 (63%)** were familiar with GEOSS
- **85 (73%)** of the users classified themselves as scientist/researcher; 4 (3%) policy analyst; 3 (2%) decision support; negligible other classifications
- **58 (49%)** were experienced application users;
  34 (29%) were casual users;
  19 (16%) were software development oriented

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Evaluation of Existing GCI Components – ISRSE-33

- **Subjects searched**: env. data (e.g., air and water quality, soil erosion); agriculture/forestry data; disaster/flood data, health information; satellite imagery (e.g., data & maps); weather, wind energy.

- **Identified the requirement to improve the registration process (which is continually being addressed) and the need for sub-SBA categories.**

GCI Action Plan – Summer 2009

Usability factors were included in an "Action Plan" to address GCI issues identified during the ISRSE-33 user testing.

The Action Plan was developed in June-July, with work being completed by end-August.

As a follow-up, a second-round of **Usability testing** is underway in September.

(Thanks again to the US EPA and UIC for supporting / organising this.)

Recommendations for long-term GCI operations

In accordance with the IOC-TF ToR, the key logistical items that the IOC-TF were asked to address in a **Recommendations Report**, together with those issues that have arisen during the Initial Operating Capability (IOC) phase, will be treated under the following headings:

- **Access control and security**
- **Software licensing and ownership (intellectual property rights)**
- **Maintenance**
- **Enhancements**
- **Sustainability (including funding issues)**
- **Models for GCI solutions**

Additions

- **The Content of the GCI Component and Service Registry (CSR); and**
- **Actions arising from the GEOSS Data Sharing Principles Implementation Guidelines that impact upon the GCI.**

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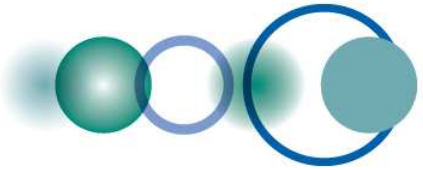

EXECUTIVE SUMMARY

- GCI SHOULD MOVE TO SUSTAINED OPERATIONAL BASIS
- GEO COMMUNITY SHOULD AGREE ON THE MEANS THROUGH 2015
- PREFERRED SCENARIO-VOLUNTARY MECHANISM ESTABLISHING A SUSTAINED COMMITMENT
- ALL GCI PROVIDERS ACCEPT GCI CONSOLIDATED REQUIREMENTS
- GCI PROVIDERS PROVIDE LEVEL OF RESOURCES DURING 2010-2015
- GEO CREATE A RESERVE FUND
- WORK OVERSEEN BY GCI ENTITY UNDER THE ADC WITH A DIVERSE REPRESENTATION. GEO SECRETARIAT SHOULD HAVE AN EXPERT ON THE GCI

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Summary of Recommendations

1. **GEO must commit to sustained operation of the GCI**
2. **User-oriented testing should be conducted on a periodic basis as input to GCI solution updates**
3. Audience for GEOSS/GCI will be initially experienced issue-oriented users, with increased citizen support over time as the GCI matures
4. GCI recognizes and supports the GEOSS Data Sharing Principles
5. **Data access control and user management should be investigated to monitor usage and support access to more contributed systems**

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Summary of Recommendations, continued (1)

6. **GCI should support the GEOSS Quality Assurance Strategy**
7. **Software components must have open-standards-based interfaces**
8. **Operation, maintenance, and enhancement of GCI must not be adversely affected by licensing or intellectual property rights restrictions**
9. **The Architecture Implementation Pilot process is recommended as an integrated, periodic, lifecycle solution to support GCI evolution**

QUALITY CONTROL CONSIDERATION

Quality management of all GEOSS Registry content needs to be addressed as an operational expectation. **[Individuals and / or Organisations]** need to be accountable for the review (moderation) of the content to assure a high and consistent quality of the information published. This governance responsibility has not been consistently acknowledged by all registries to-date but should be provisionally addressed by the requirement, "Quality management of content" referenced by Concept of Operations document Section 4.2. Originally targeted at only the GEO Web Portals, this now applies to all GCI Components.

Indeed, the GEOSS 10-year Implementation Plan Reference Document states: "*GEOSS will advocate the association of quality assessments with all Earth Observation data. It is clear that observation data of known quality from calibrated sensors are essential*".

Calibration must also be addressed during product creation and validation is required

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Summary of Recommendations, continued (2)

10. (i) Sustained commitments are required from all GCI solution providers to ensure continued operations

- (ii) Interoperability between both data and information products should be facilitated through both identified standards and best practices
- (iii) GCI experts should work with community experts to integrate the GEOSS with SBA application scenarios

11. **Improved effort to facilitate the registration of GEOSS resources and to identify and publicise the benefits of registration of EO resources**
12. Quality of registered resources will be improved through review of GEOSS content and regular checking of registered Web service interfaces
13. Continue to promote the nomination and registration of standards and special arrangements with a focus on identifying those most commonly applied

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GCI CONTENT

It is recognized that in order to realize the full potential of the GEOSS, sufficient content must be registered in the Component and Service Registry (CSR) by GEO Members and Participating Organizations, **as the GCI is only as valuable as the sum total of its content**. Further, the aspirations and expectations of GEOSS users, including the interests of GEO Members and PO, cannot be fully realized without adequate content.

However, it must be acknowledged that during the Initial Operating Capability Phase (IOC) the GEO Community failed to register a critical mass of GEOSS resources in the CSR. In addition, the level of descriptive detail (metadata) typically provided limited the discovery and application of registered information. This lack of content raises serious concerns about the credibility, viability and long-term sustainability of the GCI.

Hence there is a clearly identified need to substantially increase the number and descriptive content of GEOSS resources registered in the GCI, including components, services and interoperability practices (standards and best practices)

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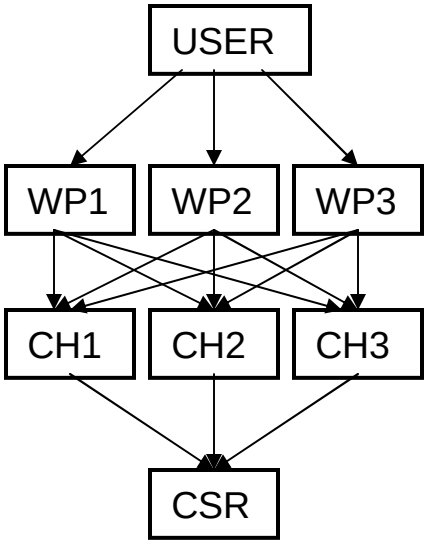
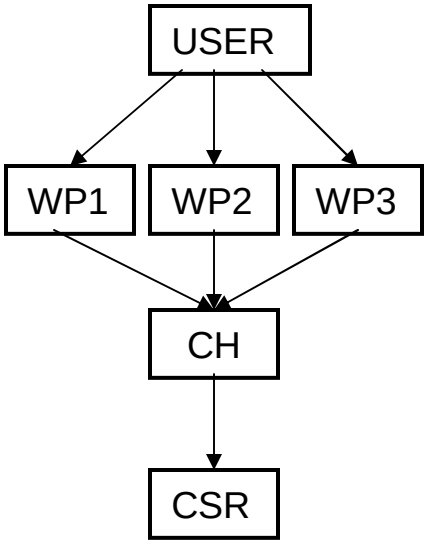
Summary of Recommendations, continued (3)

14. Contributions to the Best Practices Wiki should be more strongly encouraged by GEO
15. **For Clearinghouse access to registered catalogue content, both distributed search and harvesting approaches will be warranted**
    - **Focus GEOSS contributor efforts on describing and serving EO data through standards-based service interfaces**
16. **Define and execute a process for selection of a single Clearinghouse solution for GCI**
17. **Define justification criteria to identify a single or multiple GEO Web Portal solutions approach to satisfy GEOSS-wide access requirements and Portal re-deployment**

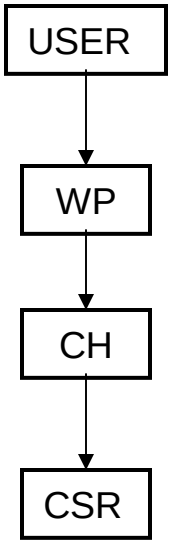
Operational scenario: single versus multiple GCI Components



Current GCI configuration IOC phase 2008-2009



Single CH / multiple Web Portal GCI configuration operational phase 2010-2015



Single CH / single Web Portal GCI configuration operational phase 2010-2015

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Summary of Recommendations, continued (4)

18. GCI deployment shall not allow a single point of failure to inhibit access to GEOSS resources
19. **GCI solutions offerings must include a commitment, roles, and responsibilities for operations, maintenance, and enhancements between the operators and GEO**

- **The actual cost of operations of GCI offers should be identified and summarized as a community investment in GEOSS**
- **A GCI Coordinating Entity is proposed to oversee the operational phase of GCI in the context of GEOSS**

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Recommended Operational Model

In light of experience & taking account of the "GEO model", the scenario currently preferred by the IOC-TF is one that:

"**via a suitable voluntary mechanism establishes a sustained commitment on the part of the GCI component providers to GEO to contribute the required components & resources to an operational framework that ensures the sustained operation of the GCI**."

In addition, the GEO should create a reserve fund that can be used to address issues arising during the GCI operational phase that supplement the commitments of the GCI component providers.

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Recommended Operational Model

The GEO Community recognised in the 2007 Cape Town Ministerial Declaration the need for "*[the GEO to] commit to explore ways and means for the sustained operations of the shared architectural GEOSS components and related information infrastructure*."

It must be emphasised, therefore, that <u>the GCI has to move to a sustained operational basis.</u>

The GEO Community therefore now needs to agree on the means by which it will enable such operation of the GCI through to 2015.

Including the provision of financial resources via a RESERVE FUND to support the operation of the GCI.

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ANNEXES AND APPENDICES

- Annex 1. Definitions of GCI Internal Components and External Resources that interact with the GCI
- Annex 2. Summary GEO Portal Usability Test Results
- Annex 3. Summary of GCI User Assessment Report Recommendations
- Annex 4. IOC-TF Action Plan agreed with GCI Component providers
- Annex 5. GEOSS Data Sharing Principles-Draft Implementation Guidelines
- Annex 6a. Specific results of the Architecture Implementation Pilot 1
- Annex 6b. Specific results of the Architecture Implementation Pilot 2
- Annex 7. (Proposal for) Initial GEOSS core collection of datasets

- GEOSS Common Infrastructure (GCI) User Assessment Report

- Appendix A: GEO Portal Brochure-BEO Portals Usability Testing
- Appendix B: GEO Portals User Questionnaire
- Appendix C: GEO Portal Fact Sheets
- Appendix D: GEO Portal Sample Searches
- Appendix E: GEO Portal Usability Questionnaire Results

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Thank You

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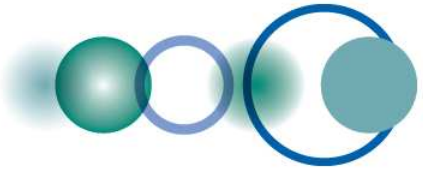

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PREAMBLE

IOC-TF Charge: Report to GEO ExCom

- Define and recommend a Concept of Operations Plan
- Evaluate existing GCI Components and their sustained operation
- Provide administrative recommendations re models of GCI operational solutions

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DELIVERABLES

- Concept of Operations Document
- Evaluation of GCI Components
  - GCI Verification Test Plan
  - Report on the Evaluation of the GCI Components
- Recommendations for Long-term GCI Operations (current document)

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LOGISTICAL ITEMS

- **(a) Long-term cost implications of voluntary, contributed, or contracted operations for each/all components;**
- (b) Accountability and responsibility for operations by service provider;
- (c) Presenting issues and alternatives for GCI service operations, maintenance (hardware/software and telecom), and extensibility;
- **(d) Software ownership and intellectual property issues regarding long-term operations (Proprietary versus open source concerns);**
- (**e) Operation and maintenance of single versus multiple GCI service**
- **instances (e.g. Web portals, Clearinghouses, and Registries);**
- (f) Access control and security policies on GCI services;
- (g) User interface policies in support of human and software clients, SBAs, communities of practice, and the general GEO community;
- **(h) Process for incorporating user community requirements into GCI;**
- (i) Other issues when and if appropriate.

KEY ITEMS

Original concerns

- access control and security
- software licensing and ownership (intellectual property rights)
- enhancements
- maintenance
- sustainability

In addition, further issues that have arisen during the course of the Initial Operating Capability (IOC) phase of the GCI, which ran from June 2008 through to June 2009, are also addressed.

These include:

- The Content of the GCI Component and Service Registry (CSR); and
- Actions arising from the GEOSS Data Sharing Principles Implementation Guidelines that impact upon the GCI.

RECOMMENDATIONS SUMMARY(1)

01 - The Strategic Significance of the GCI: GEO Members and Participating Organisations make, via a suitable voluntary mechanism, a sustained commitment to run the GCI on an OPERATIONAL basis.

02 - Users and the GCI: Incorporating user requirements into the GCI: Coordinated user testing exercises are undertaken on a regular basis during the operational phase of the GCI, under the guidance of the GCI coordinating Entity, to assure proper functioning of the GCI and accommodate emerging requirements, technology, and functionality, with resulting recommendations being incorporated into subsequently deployed versions of the GCI software.

03 - Users and the GCI: User interface policies: The initial user focus of the GCI, i.e., through to the GEO-VII Plenary at the latest, should be targeted at experienced issue-oriented users for whom the GEOSS can add clear extra added-value, with the user scope being broadened to support general citizen access as the GCI matures.

04 - GEOSS Data Sharing Implementation Guidelines and the GCI: The GCI should provide efficient and effective support to the implementation of the GEOSS Data Sharing Principles;

This should be undertaken by establishing a joint working group of members drawn from the GCI coordinating Entity, the DA-06-01 Data Sharing Principles Task Team and those GCI component providers responsible for the operational implementation of the GCI.

05 – Data Access, Access control and security policies on GCI services: Standard data access and access control methodologies should be investigated and then deployed in order to support and promote more direct access to as many registered GEOSS resources as possible.

06 - Quality control considerations [2]: The GCI should be ready to accommodate and support recommendations on data quality management in accordance with the GEOSS Quality Assurance Strategy. The GCI should enable users to discover the declared quality of resources registered

in the GEOSS, enabling them to query and filter the GCI information content quality, based on the metadata provided.

RECOMMENDATIONS SUMMARY (2)

07 - Software licensing and ownership (intellectual property rights): The current prescriptions, as set out in the GEOSS 10-Year Implementation Plan, the GEOSS 10-Year Implementation Plan Reference Document and the GCI Consolidated Requirements document are retained and adhered to.

08 - Software licensing and ownership (enhancements): For the long-term success of the GEOSS: - The operation, maintenance and possible evolution of the core functional capabilities of the GCI need to be ensured, without being affected, or limited, by copyright or rights held in all deployed GCI software offerings: Registries, Clearinghouses; and Web Portals.

[For discussion as a supplement to / replacement of recommendation 8 above. - The management of the intellectual property of the GCI needs to be formalised through agreements between the GEO and any current operator or future recipient of GCI intellectual property. This is required in order to establish the perpetual availability of software, documentation and customisations made to GCI provided intellectual property for the benefit of the GEO community.]

09 – Enhancements: issues and alternatives for GCI extensibility: The Architecture and Implementation Pilots process is retained, reinforced and fully integrated into the strategy to develop and enhance the GCI in a cyclic fashion. [For discussion by the GEO Committees in Melbourne: The interface between the AIP and the GCI component providers is facilitated / overseen / supervised by the GCI coordinating Entity.]

10 – Enhancements: Planning the Development of the GCI through to 2015: During 2010

Following the GEO VI Plenary, an operational solution for all GCI components should be implemented, including sustained commitments to support the operation of the GCI in accordance with the GCI Consolidated Requirements. This should also enable the implementation of those improvements assessed as being feasible by the GCI coordinating Entity, after consultation with the GCI component providers. This solution should ensure that a fully functional and operational GCI is in place prior to the 2010 Ministerial, which has readily accessible content and that can use data interoperably to address selected societal issues.

RECOMMENDATIONS SUMMARY (3)

11 - The Content of the GCI: - The GEO Community undertakes a continuous collective effort to publicise the benefits of registration of EO resources in the GEOSS. - A proactive mechanism is implemented that actively works with potential providers to facilitate the registration of high-quality GEOSS resources and associated attributes.

12 - GCI operational issues: Component and Service Registry (CSR) - A Registration Review team shall be convened to review all GEOSS registrations through the Component and Service Registry on a regular basis to assure completeness, correctness, and availability of the resources being described. The availability of certain standards-based services, (i.e. component system interfaces), registered in GEOSS should be assessed through periodic checks of the service availability, responsiveness, and access to stated resources. The integration of a "Service Status Checker" is implemented into the CSR for recognized standard service types for the operational phase of GCI.

13 - GCI operational issues: Standards and Interoperability Registry (SIR): A process is established that:

a) Reaffirms the 10 year plan commitment to GEOSS interoperability be based on nonproprietary standards, with preference given to formal international standards;

b) Recognises the most common standards and special arrangements that are used by a large fraction of the resources registered in the GEOSS;

c) Works to make the data from these providers interoperable;

d) Looks to consolidate the preferred standards for GEOSS to maximise interoperability within the GCI under the guidance of the ADC / SIF.

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RECOMMENDATIONS SUMMARY (4)

14 - GCI operational issues: Best Practices Registry: A process is established that:

a) Complements the most common standards and special arrangements with the identification of best practices employed in generation of data and information products, thereby substantially improving interoperability and quality assurance for GEOSS;

b) Facilitates the community acceptance of best practices through a registry-based peer review process;

c) Facilitates contributions to the registry through creation of an active team of experts to work with contributors and users. Contributions to the registry should be strongly encouraged by GEO and a registry that includes a peer review process should be Maintained.

15 - GCI operational issues: GCI Clearinghouse(s) and Data Access: - In order to access resources contained within catalogue(s) of data holdings, the need to implement both distributed search and harvesting techniques is recognised and implemented, as appropriate. GEO Members and Participating Organizations focus efforts on describing and serving EO data through standards-based services that are registered with the CSR (or a registered catalogue) in order to maximize access to data. This becomes an added value of GEOSS affiliation. Adequately detailed metadata must be provided and registered by GEO Members and Participating Organisations to facilitate data and service discovery, assessment, and integration for decision support and SBA applications.

16 - Operation and Maintenance of single versus multiple GCI components: GCI Clearinghouse(s): A process for the selection of a single Clearinghouse is implemented prior to the operational phase of the GCI.

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Presentation Overview

- **The GEOSS Common Infrastructure (GCI)**
- **GCI Initial Operating Capability (IOC) Task Force**
- **Testing of Existing GCI Components**
- **Recommendations for GCI Operations**

RECOMMENDATIONS SUMMARY (5)

17 - Operation and Maintenance of single versus multiple GCI components:
GCI GEO Web Portal(s):
For discussion:

- A single GEO Web Portal is implemented during the operational phase of the GCI that provides end-user access to all registered GEOSS resources. Additionally, other Web Portal instances may be recognized by GEO as GEO Community Web Portals that provide custom access to specialized community content; the resources identified in any GEO Community Portal/catalogue must also be discoverable through the main GEO Web Portal. The identification of a single GEO Web Portal for GEOSS-wide access is essential to promote consistent access and to avoid confusion by GEOSS users.

OR

- Multiple GEO Web Portals are accommodated within the GCI that provide end-user access to all registered GEOSS resources, subject to a satisfactory arrangement(s) being established which ensures the coordination of the various activities of the GEO Web Portal providers, under the guidance of the GCI coordinating Entity. The benefits of multiple portals are to provide the users with more complete information, services and tools than via a single portal. Availability of multiple GEO Web Portals can also stimulate the Portal Providers to provide the most complete and up-to-date

I nformation, as well as more performant user services.

18 - Models of sustainable GCI operational solutions: Whatever scenario is adopted to enable the sustained operation of the GCI, it must ensure that within the GCI there is no single point failure that could shutdown critical GCI functions for a long time.

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RECOMMENDATIONS SUMMARY (6)

19 - Models of sustainable GCI operational solutions: In light of experience to date and taking account of the "GEO model", the currently preferred scenario is one in which:

- The sustained operation of the GCI during the period 2010-2015 is based upon the voluntary contribution of the required GCI components and resources and a reserve fund that can be used to address issues arising during the GCI operational phase that supplement the commitments of the GCI component providers;

- An operational framework is established between the GCI component providers and GEO that ensures the sustained operation of the GCI;

- All GCI component providers are required to accept, abide by and implement the requirements set out in the current GCI Consolidated Requirements document;

- The work of operating, developing and implementing the GCI is overseen by a single, small, GCI coordinating Entity under the auspices of the ADC. ;

- The GCI coordinating Entity should be given a formal remit by the GEO Plenary to undertake this task and to report to EXCOM and Plenary on a regular basis on the operation and development of the GCI;

- An assessment of the resources required to undertake the sustained operation of the GCI is made in terms of voluntary and reserve funding requirements;

- This operational solution is reviewed and if necessary revised, if it is found to be unable to provide the anticipated results.

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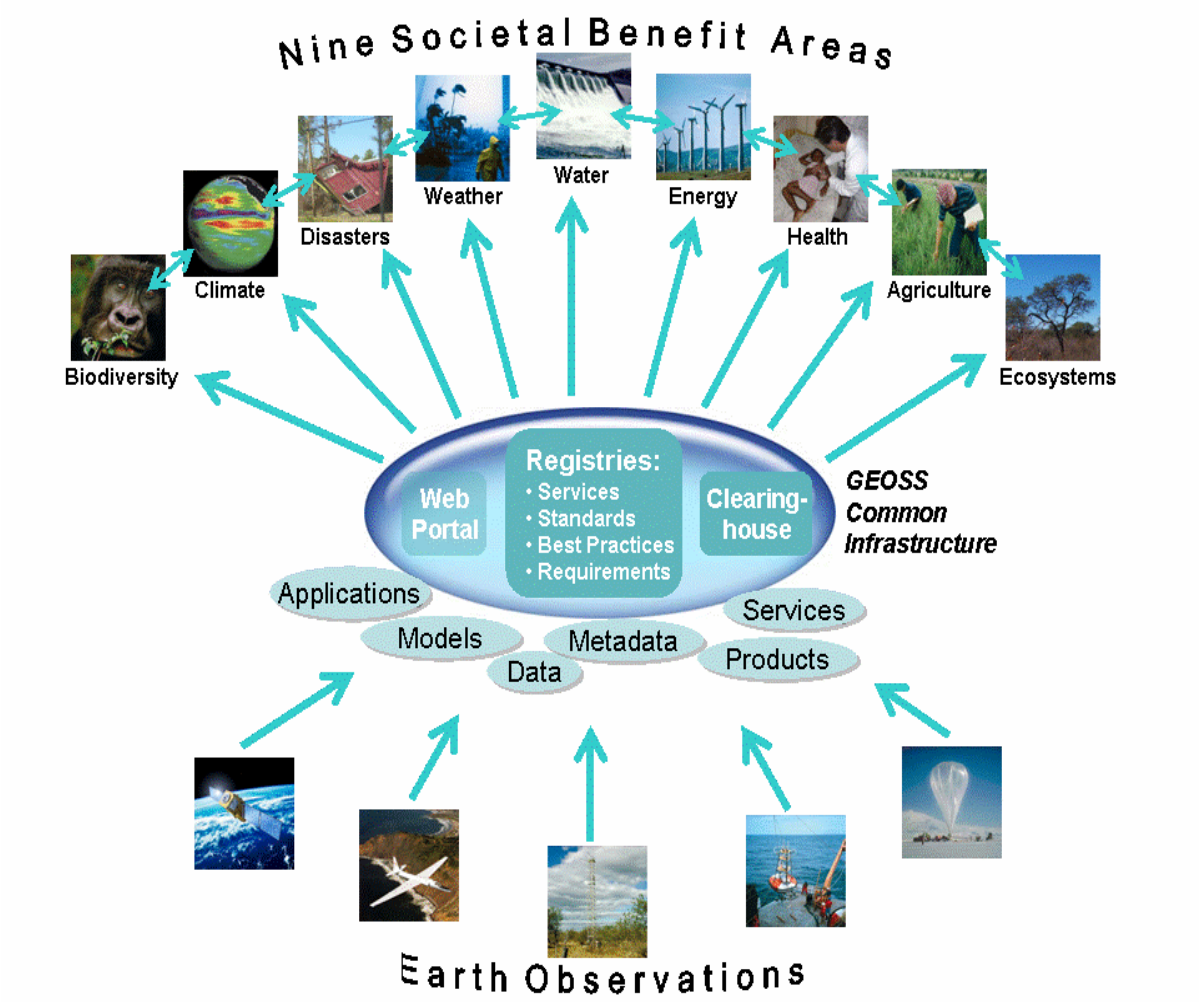
GEOSS COMMON INFRASTRUCTURE (GCI)



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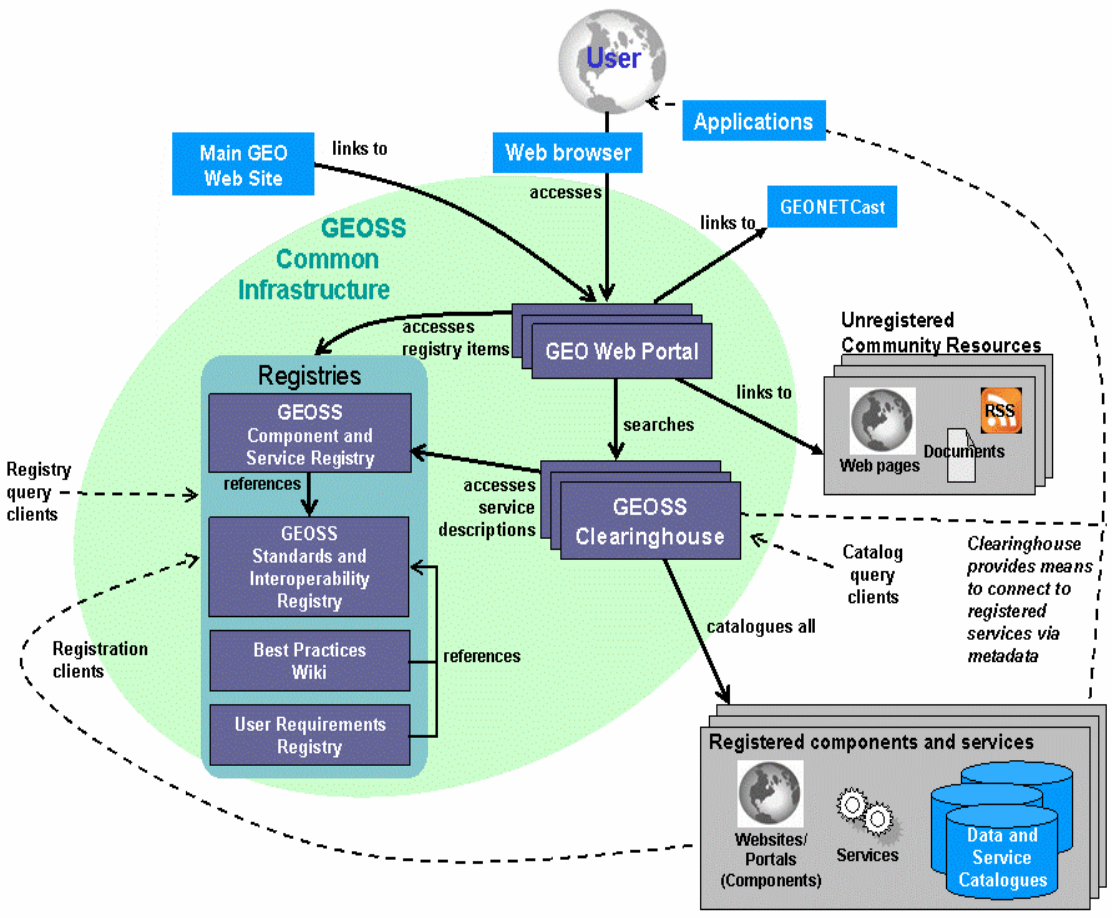
GCI/EXTERNAL RESOURCES RELATIONSHIPS



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01 - The IOC Task Force therefore recommends

- GEO Members and Participating Organizations make, via a suitable voluntary mechanism, a sustained commitment to run the GCI on an OPERATIONAL basis.

- *Before 2015, GEO aims to*:

  ***Achieve sustained operation**, continuity and interoperability of existing and new systems that provide essential environmental observations and information, **including the GEOSS Common Infrastructure (GCI)** that facilitates access to, and use of, these observations and information*.

USER TESTING

As a first step towards incorporating user requirements into the GCI, user testing took place from 4-8 May at the ISRSE-33 Symposium in Stresa, Italy. This was supported by the User Interface Committee (UIC) and the US EPA, who provided personnel and logistical support for this testing. The setup was designed to accommodate around 100 to 150 tests during the four days using one of the Portals in a test. 117 tests were performed during this period. Attendees at the Symposium and the GEO meetings came at random to do the test.
The results provided much needed feedback on the many problems existing in the GCI at that time. About two-thirds of the testers had not visited the Portals before, indicating that new users were engaged. A large majority said that they would visit the portals again and all of them had suggestions for improvements which they felt were needed to improve the Portals and the GCI.

The document includes a draft report for the EPA “GEOSS Common Infrastructure (GCI) User Assessment Report”

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02 - The IOC Task Force therefore recommends

- Coordinated user testing exercises are undertaken on a regular basis during the operational phase of the GCI, under the guidance of the GCI coordinating Entity, to assure proper functioning of the GCI and accommodate emerging requirements, technology, and functionality, with resulting recommendations being incorporated into subsequently deployed versions of the GCI software.

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ACCESS CONTROL AND SECURITY

Services providing access to Earth Observation data and products
often include significant requirements for assuring various aspects of security and authentication.
These range from:

- authentication of user identity for data with restricted access;
- to notification of copyright restrictions for data not in the public domain;
- and mechanisms for assurance that data is uncorrupted.

In addition to security, accommodations will need to be made regarding possible data and information charges and fees, when appropriate.

The above raises various issues, such as whether:

a) Users of the GEOSS should be required to complete a registration process before first using the GCI;

b) Users of the GEOSS should be required to logon each time they use the GCI;

c) Mechanisms to accommodate licensing agreements / charges for the use of GEOSS data should be included in the GCI;

d) "Tracking" facilities should be introduced to monitor the reuse / redissemination of GEOSS data

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05 - The IOC Task Force therefore recommends

Standard data access and access control methodologies should be investigated and then deployed in order to support and promote more direct access to as many registered GEOSS resources as possible.

SOFTWARE LICENSING AND OWNERSHIP (INTELLECTUAL PROPERTY RIGHTS)

Proprietary versus open source concerns;

The GEOSS 10-Year Implementation Plan states: "*For the most commonly used open-standard interfaces, the GEOSS process will advocate some implementations having no restrictions on being modified freely, commonly known as “open-source” software.*“

This is elaborated in the GEOSS 10-Year Implementation Plan Reference Document, in particular in the box labeled "***Open Standards and Intellectual Property Rights***", where it is stated that "*GEOSS will not require any commercial or other proprietary standards**, following the policy that software components must have open-standards-based interfaces**.*"

GROUP ON EARTH OBSERVATIONS

07 - The IOC Task Force therefore recommends

The current prescriptions, as set out in the GEOSS 10-Year Implementation Plan, the GEOSS 10-Year Implementation Plan Reference Document and the GCI Consolidated Requirements document are retained and adhered to.

GROUP ON EARTH OBSERVATIONS

LONG TERM OPERATIONS

The continuous operation and maintenance of all GCI software may be affected by copyright or rights held in all deployed GCI software offerings: Registries, Clearinghouses and Web Portals.

For discussion: S Browdy and D Nebert

GROUP ON EARTH OBSERVATIONS

DISCUSSION ISSUES

It is necessary to take into account the issues of the availability of the software and related Intellectual Property (IP). The IOC-TF would therefore propose that all documentation (installation, configuration, and operation) and software for GCI components be contributed to an escrow holding, by some authoritative body (possibly GEO). The escrow contribution should be updated as new versions of the GCI components are released.

It is also suggested that an agreement be crafted to ensure that any, and all, intellectual property rights that may exist, and be owned by the GCI provider, be assigned to GEO.

A further issue relates to the GCI components being made available to anyone to implement and make customized improvements. There should be an agreement between GEO and the recipient of the GCI component code, to provide documentation and customization back to GEO, so that GEOSS can benefit from any potential improvements made. This will not only protect GEOSS from being competitively disadvantaged, but will also help GEOSS evolve.

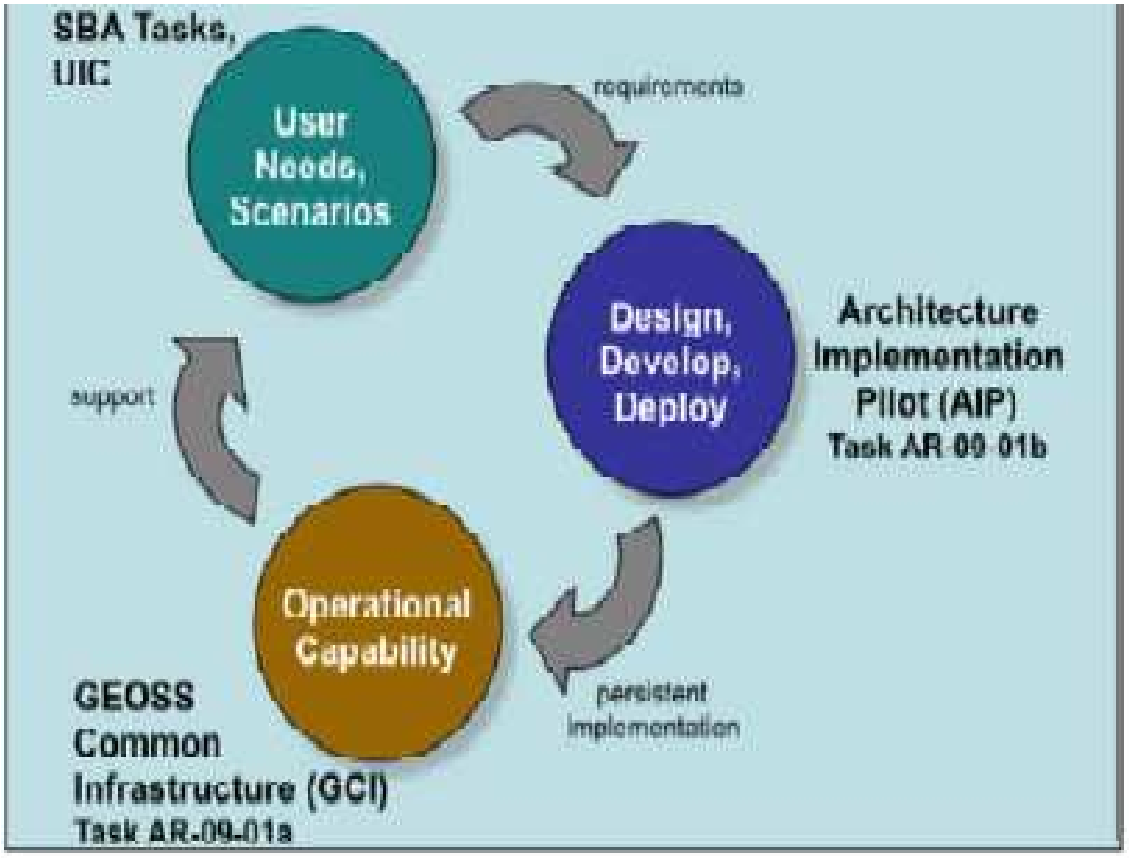
08 - The IOC Task Force therefore recommends

For the long-term success of the GEOSS: The operation, maintenance and possible evolution of the core functional capabilities of the GCI need to be ensured, without being affected, or limited, by copyright or rights held in all deployed GCI software offerings: Registries, Clearinghouses; and Web Portals..

For discussion as a supplement to / replacement of the recommendation above. (From S Browdy & D Nebert.)
- The management of the intellectual property of the GCI needs to be formalized through agreements between the GEO and any current operator or future recipient of GCI intellectual property. This is required in order to establish the perpetual availability of software, documentation and customisations made to GCI provided intellectual property for the benefit of the GEO community

GROUP ON EARTH OBSERVATIONS

Enhancements



GROUP ON EARTH OBSERVATIONS

ENHANCEMENTS

A phase of the elaboration process begins with identification of user needs and SBA scenarios – a step conducted through collaboration between the UIC and ADC. The results of this first step become requirements for a phase of the Architecture Implementation Pilot (AIP) – Task AR-09-1b – where interoperability tests are conducted between contributed components; results are documented as architecture reports and Interoperability Arrangements; with demonstrations to show how the SBA scenarios have been archived. The results of AIP as “pilot” or “beta” level- maturity components are then transitioned to the operational capability developed and managed in Task AR-09-01a, "Enabling Deployment of a GEOSS Architecture".

GROUP ON EARTH OBSERVATIONS

09 - The IOC Task Force therefore recommends

The Architecture and Implementation Pilots process is retained, reinforced and fully integrated into the strategy to develop and enhance the GCI in a cyclic fashion.

GROUP ON EARTH OBSERVATIONS

GCI CONTENT

It is recognized that in order to realize the full potential of the GEOSS, sufficient content must be registered in the Component and Service Registry (CSR) by GEO Members and Participating Organizations, **as the GCI is only as valuable as the sum total of its content**. Further, the aspirations and expectations of GEOSS users, including the interests of GEO Members and PO, cannot be fully realized without adequate content.

However, it must be acknowledged that during the Initial Operating Capability Phase (IOC) the GEO Community failed to register a critical mass of GEOSS resources in the CSR. In addition, the level of descriptive detail (metadata) typically provided limited the discovery and application of registered information. This lack of content raises serious concerns about the credibility, viability and long-term sustainability of the GCI.

Hence there is a clearly identified need to substantially increase the number and descriptive content of GEOSS resources registered in the GCI, including components, services and interoperability practices (standards and best practices)

GROUP ON EARTH OBSERVATIONS

11 - The IOC Task Force therefore recommends

- The GEO Community undertakes a continuous collective effort to publicize the benefits of registration of EO resources in the GEOSS.
- A proactive mechanism is implemented that actively works with potential providers to facilitate the registration of high-quality GEOSS resources and associated attributes.

- (Considerable discussion followed re metadata adequacy)

GROUP ON EARTH OBSERVATIONS

BEST PRACTICES REGISTRY

The key to an operational best practices registry is the breadth and completeness of the submissions and the uptake by the community of the peer review dialogue to foster convergence. To date, there have been limited contributions to the best practices registry, with contributions primarily in the areas of information management and associated processes. Members and Participating Organizations seeking to stimulate interoperability should encourage their organizations to take an active role in contributing to and using the Best Practices Registry.

GROUP ON EARTH OBSERVATIONS

GCI CLEARINGHOUSE AND DATA ACCESS

When "Registering, searching and accessing Catalogues", many data holders have shown a clear preference for registering their catalogue(s) of data holdings, as opposed to the actual datasets themselves. This is understandable, as for organisations with significant data holdings, the work required to register the actual individual datasets would be immense. However, to access the resources held in these catalogues requires the implementation of either a distributed search, or they are harvested on a recurrent basis.

GROUP ON EARTH OBSERVATIONS

15 - The IOC Task Force would recommend

In order to access resources contained within catalogue(s) of data holdings, the need to implement both distributed search and harvesting techniques is recognised and implemented, as appropriate.

- GEO Members and Participating Organizations focus efforts on describing and serving EO data through standards-based services that are registered with the CSR (or a registered catalogue) in order to maximize access to data. This becomes an added value of GEOSS affiliation.
- Adequately detailed metadata must be provided and registered by GEO Members and Participating Organisations to facilitate data and service discovery, assessment, and integration for decision support and SBA applications.

GROUP ON EARTH OBSERVATIONS

OPERATION AND MAINTENANCE

Operation and Maintenance of single versus multiple GCI service instances (e.g. Web portals, Clearinghouses, and Registries); At present there are currently single candidate providers for each of the various GCI registries. Hence this is not an issue at the level of the GCI registries. Conversely, there are multiple candidates for both the GCI Clearinghouse and Web Portal.

ISSUES:

a) The interaction between GEO and multiple providers is more complex and problematic than for a single provider – for any GCI component;

b) Operational expectations and resource requirements for multiple providers is high and is a multiplier of the required capability;

c) A single interface can reinforce the GEO / GEOSS identity, whilst multiple entry points to the same system could lead to confusion and a loss of visibility for the GEOSS.

However, the User Assessment of the GCI undertaken during the ISRSE-33 Conference that took place in Stresa, Italy, at the start of May 2009, demonstrated that the lack of a consistent search process across the GCI was confusing to users. Even more frustrating for users was the inability to obtain the same results using the same search terms on the three Web Portals.

GROUP ON EARTH OBSERVATIONS

16 - The IOC Task Force therefore recommends

A process for the selection of a single Clearinghouse is implemented prior to the operational phase of the GCI.

GROUP ON EARTH OBSERVATIONS

WEB PORTALS

None of the matters arising during the testing at Stresa indicated a requirement to restrict the GCI to only incorporating a single GEO Web Portal amongst the list of GCI components. However, there is a clear need to ensure a consistent user-interface and approach across GEO Web Portals, should multiple versions be retained during the GCI operational phase.

Further, in principle, various GEO Web Portal Providers can have additional strengths which can bring added benefits to users of a particular GEO Web Portal, (e.g. specific applications / tools using particular GEOSS data.) However, to date, such benefits that could arise from accommodating multiple GEO Web Portals within the GCI has not been fully demonstrated.

17 - The IOC Task Force therefore recommends

For discussion:

- A single GEO Web Portal is implemented during the operational phase of the GCI that provides end-user access to all registered GEOSS resources. Additionally, other Web Portal instances may be recognized by GEO as GEO Community Web Portals that provide custom access to specialized community content; the resources identified in any GEO Community Portal/catalogue must also be discoverable through the main GEO Web Portal. The identification of a single GEO Web Portal for GEOSS-wide access is essential to promote consistent access and to avoid confusion by GEOSS users.
- **OR**

  Multiple GEO Web Portals are accommodated within the GCI that provide end-user access to all registered GEOSS resources, subject to a satisfactory arrangement(s) being established which ensures the coordination of the various activities of the GEO Web Portal providers, under the guidance of the GCI coordinating Entity. The benefits of multiple portals are to provide the users with more complete information, services and tools than via a single portal. Availability of multiple GEO Web Portals can also stimulate the Portal Providers to provide the most complete and up-to-date information, as well as more performant user services

GROUP ON EARTH OBSERVATIONS

MODELS OF SUSTAINABLE GCI OPERATIONAL SOLUTIONS

When considering the various models for sustainable GCI operational solutions, the IOC-TF came to the initial conclusion that in light of experience to date and taking account of the "GEO model", the currently preferred scenario is one that "**via a suitable voluntary mechanism establishes a sustained commitment on the part of the GCI component providers to GEO to contribute the required components and resources to an operational framework that ensures the sustained operation of the GCI**."

19 - The IOC Task Force therefore recommends

In light of experience to date and taking account of the "GEO model", the currently preferred scenario is one in which:
- The sustained operation of the GCI during the period 2010-2015 is based upon the voluntary contribution of the required GCI components and resources and a reserve fund that can be used to address issues arising during the GCI operational phase that supplement the commitments of the GCI component providers;
- An operational framework is established between the GCI component providers and GEO that ensures the sustained operation of the GCI;
- All GCI component providers are required to accept, abide by and implement the requirements set out in the current GCI Consolidated Requirements document;
- The work of operating, developing and implementing the GCI is overseen by a single, small, GCI coordinating Entity under the auspices of the ADC. ;
- The GCI coordinating Entity should be given a formal remit by the GEO Plenary to undertake this task and to report to EXCOM and Plenary on a regular basis on the operation and development of the GCI;
- An assessment of the resources required to undertake the sustained operation of the GCI is made in terms of voluntary and reserve funding requirements;
- This operational solution is reviewed and if necessary revised, if it is found to be unable to provide the anticipated results.

[

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PREAMBLE

IOC-TF Charge: Report to GEO ExCom

- to define and recommend a Concept of Operations plan for the GCI components, including aspects of operational requirements, responsibilities, and interaction,
- to evaluate the existing GCI components and their sustained operation in light of known and emerging provider and user requirements, reliability, suitability, sustainability, and quality of service, and
- to provide administrative recommendations regarding models of GCI operational solutions addressing sustainability, maintenance, enhancements, access control and security, and software licensing and ownership (intellectual

GROUP ON EARTH OBSERVATIONS

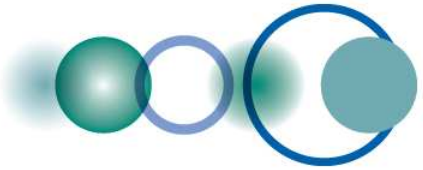
USER FOCUS

- **The initial focus of the GCI is not on the "citizen in the street"**, who will be conditioned by their experience of Google and Google Earth / Microsoft Virtual Earth, but on more experienced issue-oriented users for whom the GEOSS can add clear extra added-value beyond the capabilities of Google or Microsoft.

03 - The IOC Task Force therefore recommends

The initial user focus of the GCI, i.e., through to the GEO-VII Plenary at the latest, should be targeted at experienced issue-oriented users for whom the GEOSS can add clear extra added-value, with the user scope being broadened to support general citizen access as the GCI matures.

GROUP ON EARTH OBSERVATIONS



DATA SHARING PRINCIPLES

The GEOSS 10-Year Implementation Plan sets out the GEOSS data sharing principles as follows:

- There will be full and open exchange of data, metadata and products shared within GEOSS, recognizing relevant international instruments and national policies and legislation.
- All shared data, metadata and products will be made available with minimum time delay and at minimum cost.
- All shared data, metadata and products being free of charge or no more than cost of reproduction will be encouraged for research and education.

GROUP ON EARTH OBSERVATIONS

04 - The IOC Task Force therefore recommends

- The GCI should provide efficient and effective support to the implementation of the GEOSS Data Sharing Principles;
- This should be undertaken by establishing a joint working group of members drawn from the GCI coordinating Entity, the DA-06-01 Data Sharing Principles Task Team and those GCI component provider responsible for the operational implementation of the GCI

GROUP ON EARTH OBSERVATIONS

06 - The IOC Task Force therefore recommends

- The GCI should be ready to accommodate and support recommendations on data quality management in accordance with the GEOSS Quality Assurance Strategy.
- The GCI should enable users to discover the declared quality of resources registered in the GEOSS, enabling them to query and filter the GCI information content quality, based on the metadata provided.

GROUP ON EARTH OBSERVATIONS

PLANNING THE DEVELOPMENT OF GCI THROUGH 2015

The overall goal of the GEO, to carry out the GEOSS 10-Year Implementation Plan, is extremely ambitious. The development of a functional GCI is tightly linked to the overall implementation of the GEOSS. Hence issues connected to the GCI are likely to continue to arise through to 2015. For example, the GEO will only be able to evaluate the effectiveness of the model selected to implement sustained operations of the GCI and the associated financial / resource aspects over the medium to long-term.

10 - The IOC Task Force therefore recommends

During 2010

Following the GEO VI Plenary, an operational solution for all GCI components should be implemented, including sustained commitments to support the operation of the GCI in accordance with the GCI Consolidated Requirements. This should also enable the implementation of those improvements assessed as being feasible by the GCI coordinating Entity, after consultation with the GCI component providers. This solution should ensure that a fully functional and operational GCI is in place prior to the 2010 Ministerial, which has readily accessible content and that can use data interoperably to address selected societal issues;

In the period 2011-2015

The GEOSS should contain a significant content, including all major global EO datasets. A recommended set of standards and interoperability arrangements should be implemented. Interoperability between both data and information products should be facilitated through both identified standards and best practices. The Action Plan for the data sharing principles should, where applicable, be applied to the GCI

Recommendation 10: continued

- **The IOC Task Force therefore recommends that:**
  The GCI should also provide support to SBA Communities to use the GEOSS Architecture:

- Expertise from GEO Members, Participating Organizations and Communities of Practice should be made available to support SBA focused individuals and groups that seek to employ the GEOSS architecture to meet their EO information and processing needs;
- A reusable process is defined and refined that is available for GCI experts to work with SBA community experts to apply the GEOSS SBA Scenarios

GROUP ON EARTH OBSERVATIONS

GCI OPERATIONAL ISSUES

The Component and Service Registry (CSR) 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, modelling, 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.

12 - The IOC Task Force therefore recommends

- A Registration Review team shall be convened to review all GEOSS registrations through the Component and Service Registry on a regular basis to assure completeness, correctness, and availability of the resources being described.
- The availability of certain standards-based services, (i.e. component system interfaces), registered in GEOSS should be assessed through periodic checks of the service availability, responsiveness, and access to stated resources.
- The integration of a “Service Status Checker” into the CSR for recognized standard service types for the operational phase of GCI.

(Discussion needed re problem of good quality data linked to poor quality service)

GROUP ON EARTH OBSERVATIONS

STANDARDS AND INTEROPERABILITY REGISTER

The registration and recognition of standards within the GEOSS is essentially an open-ended process. In practice, the support of multiple standard web service interfaces presents a resourcing challenge to developers and integrators, (e.g. the Clearinghouse providers), as to what interfaces to choose to support, test, and maintain.

GROUP ON EARTH OBSERVATIONS

13 - The IOC Task Force therefore recommends

A process is established that:

a) Reaffirms the 10 year plan commitment to GEOSS interoperability be based on non-proprietary standards, with preference given to formal international standards;

b) Recognises the most common standards and special arrangements that are used by a large fraction of the resources registered in the GEOSS;

c) Works to make the data from these providers interoperable;

d) Looks to consolidate the preferred standards for GEOSS to maximise inter-operability within the GCI under the guidance of the ADC / SIF.

14 - The IOC Task Force therefore recommends

A process is established that:

a) Complements the most common standards and special arrangements with the identification of best practices employed in generation of data and information products, thereby substantially improving interoperability and quality assurance for GEOSS;

b) Facilitates the community acceptance of best practices through a registry-based peer review process;

c) Facilitates contributions to the registry through creation of an active team of experts to work with contributors and users. Contributions to the registry should be strongly encouraged by GEO and a registry that includes a peer review process should be maintained.

GROUP ON EARTH OBSERVATIONS

BEST PRACTICES REGISTRY

The key to an operational best practices registry is the breadth and completeness of the submissions and the uptake by the community of the peer review dialogue to foster convergence. To date, there have been limited contributions to the best practices registry, with contributions primarily in the areas of information management and associated processes. Members and Participating Organizations seeking to stimulate interoperability should encourage their organizations to take an active role in contributing to and using the Best Practices Registry.

Submission to the Best Practices Wiki requires more effort than a simple registration process characteristic of a traditional registry. This additional effort enables the peer review process that is essential for widespread adoption and use. If there is not sufficient interest on the part of the Members and Participating organizations to stimulate contributions to the Best Practices wiki, then a standard form of registry should be adopted. Such a standard registry would simply be a compendium of practices without a means to identify or encourage the adoption of best practices. The IOC-TF therefore encourages the maintenance of a Best Practices “Wiki” format for the implementation of the Best Practices Registry.

14 - The IOC Task Force therefore recommends

A process is established that:

a) Complements the most common standards and special arrangements with the identification of best practices employed in generation of data and information products, thereby substantially improving interoperability and quality assurance for GEOSS;

b) Facilitates the community acceptance of best practices through a registry-based peer review process;

c) Facilitates contributions to the registry through creation of an active team of experts to work with contributors and users. Contributions to the registry should be strongly encouraged by GEO and a registry that includes a peer review process should be maintained.

MODELS OF SUSTAINABILE GCI OPERATIONAL SOLUTIONS

The operation of the various Registries, Clearinghouse and Web Portal candidates has been offered by a mixture of commercial, governmental and international organizations. The GCI component candidates at this time, including three Web Portals and four Clearinghouse solutions, are as follows:

- Component and Services Registry: United States
- Standards and Interoperability Registry: IEEE
- User Needs (Requirements) Registry: United States
- Best Practices Wiki: IEEE
- Clearinghouse: Compusult, ESRI, US (USGS)
- Web Portal: Compusult, ESA / UN Food & Agricultural Organization, ESRI

As these common capabilities are fundamental to the success of GEOSS, the interruption of service caused by a provider's withdrawal could be damaging to the operation and usability of GEOSS, if no adequate measures are taken to militate against such a disruption.

GROUP ON EARTH OBSERVATIONS

18 - The IOC Task Force therefore recommends

Whatever scenario is adopted to enable the sustained operation of the GCI, it must ensure that within the GCI there is no single point failure that could shutdown critical GCI functions for a long time.

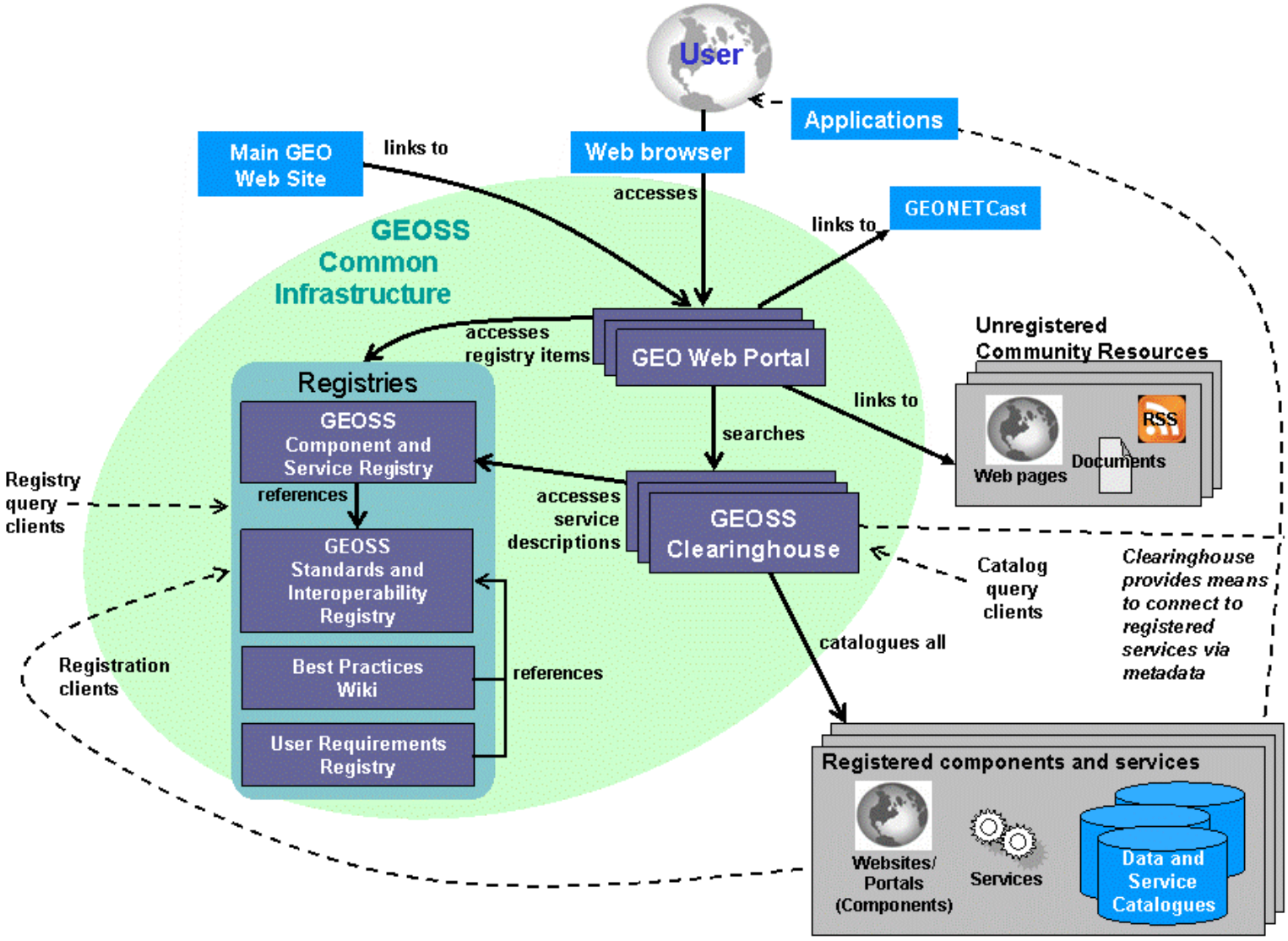
GROUP ON EARTH OBSERVATIONS

GEOSS Common Infrastructure (GCI)

- **The Cape Town Declaration: "We commit to explore ways and means for the sustained operations of the shared architectural GEOSS components and related information infrastructure".**
- GCI provides **core capabilities** that enable GEOSS resources (systems, data and products) to be discovered accessed and understood, by users and decision-makers.
- The GCI includes several **registries**, a search tool known as a "**Clearinghouse**," and **GEO Web Portals** that provide a user interface to search and access all GEOSS resources.
- The **Initial Operating Capability (IOC)** for the GCI was declared "open for business" in June 2008. It provides a one-year evaluation phase for the GEO community to use and deliver feedback.

GROUP ON EARTH OBSERVATIONS

GCI operational interaction diagram



GROUP ON EARTH OBSERVATIONS

GEO IOC Task Force

- **Established by the GEO Executive Committee in July 2008 for a period of 1 year in support of the GEOSS IOC phase.**
- **Charged with evaluating the GCI initial operating capability and developing recommendations for the sustained operations of the GCI.**

GROUP ON EARTH OBSERVATIONS

Evaluation of Existing GCI Portals – ISRSE-33

Summary of usability suggestions for improvement

- Provide more end-user support (tips and tutorials, let users provide feedback, include page help and FAQ)
- Improve map visualizations (speed, launch KML files in external map/globe viewers)
- Improve search tools to retrieve more consistent relevant hits
- Provide less text and more colourful images
- Search geographically and thematically at the same time

GROUP ON EARTH OBSERVATIONS

Evaluation of Existing GCI Portals – ISRSE-33

- **Ease of use:**
- **45 (39%)** scored the Portal nav. capabilities as **easy**;
- **31 (27%)** scored the Portal nav. capabilities as **mid-range**;
- **39 (34%)** scored the Portal nav. capabilities as **difficult**.

- **Most useful Portal features:**
  mapping interface (e.g., map search field, map viewer); drop down menus; globe; search system; web GIS features, browsing tool.

- **Difficult to use Portal features:**
  area of interest tool; SBA search; legends/colour interpretations; map; globe view; simple search