

Canadian Geoscience Knowledge Network Business Plan

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Executive Summary

To enhance access to government geoscience knowledge, the National Geological Surveys Committee member agencies have developed a vision of a Canadian Geoscience Knowledge Network, or CGKN. This Internet-based network will link government sources of geoscience knowledge across Canada and become both the geoscience node of the Canadian Geospatial Data Infrastructure and the national Internet portal to government geoscience knowledge. The Canadian Geoscience Knowledge Network has been identified as a key strategy of the Intergovernmental Geoscience Accord for the management and dissemination of geoscience knowledge. In the past two years two successful workshops have confirmed this strategy and defined a path for development

The National Geological Surveys Committee has delegated responsibilities for CGKN development and coordination to the CGKN Steering Committee and CGKN Secretariat. The CGKN Executive Champion is responsible for coordination between NGSC and the Steering Committee and Secretariat. The Steering Committee sets the vision and priorities and the Secretariat coordinates and supports technical and project working groups.

CGKN Objectives:

- To provide a single Internet portal that will facilitate discovery and evaluation of NGSC agency data and link the client to the data provider.
- To provide the infrastructure, tools, and standards required for capturing, managing and disseminating consistent and interoperable NGSC geoscience knowledge via the Internet.
- To implement a “loosely-coupled” architecture that allows jurisdictions to exchange and provide access to consistent and interoperable geoscience information without the need for extensive changes to their existing systems and infrastructure.
- To provide national coverage at regional scales for key data types.
- To allow NGSC data holdings to be accessed through CGKN and CGDI services.
- Enable each NGSC member agency to deliver geoscience information independently or through common services in conformity with CGKN national standards.

CGKN Benefits:

Benefits of participation in the CGKN include:

- Cost savings through cooperative shared development of standards, tools, and systems for management and dissemination of geoscience data.
- Improved service by providing a single geoscience portal through which clients will be able to quickly discover, view, evaluate, and obtain geoscience data from NGSC agencies.
- Establish national standards for terminology and exchange of geoscience data.
- The resulting network of geoscience information will position NGSC member agencies, and the nation, as a global leader in provision of rapid access to geoscience data.

CGKN Development Guidelines

- The CGKN is a National Geological Surveys Committee initiative. The NGSC will approve a CGKN management structure and assign responsibilities within that structure. One NGSC member will be designated to be CGKN Executive Champion and will be responsible for tabling CGKN recommendations, progress reports, and project proposals at NGSC meetings.
- The CGKN will be developed through a phased approach addressing in order of priority, discovery, evaluation, and access.
- Each geological survey will participate in the CGKN at its own rate and fund its own activities, manage and maintain its information holdings locally, and decide on priorities for incorporation of its information into the CGKN.
- Key data sets for which the CGKN will provide consistent national coverage must be identified through a process of consultation involving the surveys and both traditional and potential users of geoscience information.
- The CGKN will adopt existing international standards, protocols, data models, and methodologies as required to meet immediate needs and long-term goals.

Current Implementation Plan

The Canadian Geoscience Publications Directory (on-line) currently supports on-line discovery of Canadian government geoscience maps and publications. The federal Targeted Geoscience Initiative is currently funding a project that will enhance the publications directory to include information about agency data holdings (completion in 2002). Several collaborative proposals addressing development of the methodology for on-line viewing and integration of geoscience data from distributed agency sources have been prepared and submitted to GeoConnections, the GSC's proposal system and other potential funding sources for evaluation.

Due to the incremental approach to CGKN implementation and each agency's control of the participation in the CGKN, neither the overall cost of implementing the CGKN nor the cost to each agency can be accurately specified at the outset. However, the costs and benefits of participation in each CGKN project will be clearly identified in the proposal for that project.

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1) Context

1.1) Introduction

Dramatic advances in data management and communications technology during the last decade have presented many new opportunities for government and business. Within the Canadian geoscience community, the 90's were a period of rapid evolution as digital methodology was developed to support geoscience data acquisition and management, cartography, and publication. At many geological surveys, including the Geological Survey of Canada (GSC), this evolution was particularly evident in the field of geological mapping. By the end of the decade, initially independent GSC methodology developments in field systems, GIS-based project data management (Broome et al. 1994, Viljoen 1997), and digital cartography had coalesced into comprehensive digital mapping systems. Geological data now remain in the digital domain from field acquisition through to publication and can be efficiently integrated with other geoscience data. At the project and agency levels, this system has resulted in significant improvements in mapping efficiency, faster release of map products, and the ability to publish project and map data in digital form.

During the same period that geological mapping and other geoscience activities were becoming increasingly "digital", other changes were taking place that would impact the geoscience community and geological surveys in particular. These changes were driven to a large degree by technical developments such as the rapid growth of the Internet and dramatic improvement in the capability, affordability, and usability of the software and hardware for network-based dissemination of large volumes of distributed geospatial data. These technical development have led to the growing importance of the Internet as a commonly used source for scientific and other knowledge, and worldwide recognition of the value of developing network-based knowledge infrastructures at national and global levels. Geological surveys around the world are currently investing in development of client-focussed Internet access to their knowledge assets and integrate them into state/provincial, national, and international geospatial data infrastructures.

Geological surveys in Canada have seen a gradual broadening of their mission during the decade from geoscience research, frontier exploration, and support for national resource exploration, to encompass also management of the national geoscience knowledge base to support sustainable economic growth, environmental management, and health and safety. With this change has come the realization that existing geoscience products and delivery methods do not meet the needs of non-geoscience users, and also can be significantly improved for traditional users. It is clear we need to both improve access to our geoscience knowledge and delivery it in a form that allows it to be more easily understood by non-experts.

1.2) NGSC Priorities

In Canada, government geoscience data are collected and maintained by 12 provincial and territorial geoscience agencies and the federal Geological Survey of Canada, which operates 6 offices across Canada. Survey activities are coordinated through the National Geological Surveys Committee and the nature of this cooperation is documented in the Intergovernmental Geoscience Accord (IGA). The IGA defines the roles and responsibilities of federal, provincial and territorial government geoscience agencies, outlines the principles of cooperation that will optimize utilization of resources, and establishes mechanisms to optimize cooperation and collaboration among the geological survey organizations.

Provincial geological surveys have two priorities: increasing the knowledge of geoscience through mapping and information gathering, and organizing and disseminating this information in a timely and useful manner. Although the interests of the provincial surveys are restricted to issues within their boundaries, there is general agreement that a cooperative strategy for managing, disseminating and exchanging geoscience information would be of benefit for all.

In 1998, the NGSC became actively involved in development of the CGKN concept and, in the spring of 2000, endorsed the CGKN plan developed at the June 2000 Workshop. The CGKN is identified in the IGA as the principal geological survey organization instrument for geoscience knowledge integration and access.

2) CGKN Vision

The CGKN is envisioned as becoming the geoscience node of Canadian Geospatial Data Infrastructure and the Canadian geoscience portal on the Internet linking and integrating Canadian geoscience information from all surveys. The Canadian Geoscience Knowledge Network (CGKN) concept evolved from a requirement for improved access to more consistent geoscience knowledge expressed in a number of workshops and reports (see Appendix 1). The principal recommendation of a GSC Bedrock Geoscience Workshop held in 1997, was “development of an integrated, digital, scale-independent, 4-D bedrock geoscience knowledge base for Canada”. Innovative projects demonstrating the viability of Internet-based dissemination of geoscience data were also influential such as a British Columbia Ministry of Energy and Mines Internet site called “The Map Place” (<http://www.em.gov.bc.ca/mining/Geosurv/MapPlace/default.htm>). The Map Place effectively demonstrated the feasibility of Internet access to geoscience data by allowing users to efficiently discover, view, query, and download geoscience data.

The first collaboration of Canadian geological surveys toward CGKN objectives was the Canadian Geoscience Publications Directory (<http://ntserv.gis.nrcan.gc.ca/>). This online catalogue supports Internet searches for all geoscience products published by Canadian government agencies. To create the Canadian Geoscience Publications Directory,

surveys first developed a standard metadata profile and then proceeded to prepare metadata in conformity to the profile. The web site supports interactive geographic and text-based searches and displays the results on a backdrop of geological maps with scale-appropriate detail. The publications catalogue can also be searched using other FGDC/Z39.50 compliant search engines such as CEONet, the Canadian Geospatial Data Infrastructure (See Appendix B) search engine (<http://ceonet.cgdi.gc.ca>) thus supporting broader access to geoscience information. The Canadian Geoscience Publications Directory is a successful project that has been instrumental in demonstrating the benefits of cooperative service development and identifying a number of technical and policy issues that must be resolved to successfully build the CGKN.

3) Overall Objectives

Overall objective of the CKGN are the following:

- 1) To provide a single Internet portal that will facilitate discovery and evaluation of NGSC agency data and link the client to the data provider.
- 2) To provide the infrastructure, tools, and standards required for capturing, managing and disseminating consistent and interoperable NGSC geoscience knowledge via the Internet.
- 3) To implement a "loosely-coupled" architecture that allows jurisdictions to exchange and provide access to consistent and interoperable geoscience information without the need for extensive changes to their existing systems and infrastructure.
- 4) To provide national coverage at regional scales for key data types.
- 5) To allow NGSC data holdings to be accessed through CGKN and CGDI services.
- 6) Enable each NGSC member agency to deliver geoscience information independently or through common services in conformity with CGKN national standards.

4) Clients and Stakeholders

All NGSC agencies will be encouraged to participate in the development of the CGKN. Each agency will be able to influence the goals and priorities of the CGKN through their Steering Committee and NGSC/CPG representative.

The variability of mandate, mission, resources, and business modes in NGSC agencies necessitates a flexible non-intrusive approach to participation. Each agency will be able to participate in the CGKN in a manner that conforms to its policies, needs, and priorities. This flexible approach to participation will result in agencies being more active in some CGKN initiatives than others and to develop their CGKN components at different rates.

The CGKN steering committee must be active in monitoring development of agency CGKN Nodes to ensure that no one gets "left behind" and that each agencies node will fit within the broader national geoscience information infrastructure.

For successful implementation and delivery of the Canadian Geoscience Knowledge Network, the roles and responsibilities of stakeholders and clients must be clearly identified.

4.1) Stakeholders

Stakeholders must be correctly matched to their level of responsibility for a meaningful development of the network. Four levels of stakeholders have been identified:

Data Custodians

Data custodians are those who have responsibility for maintenance of geoscience knowledge. These responsibilities include how geoscience data is captured, managed and disseminated so as to meet the requirements of the CGKN initiative. The actual implementation of these mechanisms can be assigned to qualified technical staff or contractors.

Data Providers

Data providers are the point of contact for client inquiries and are responsible for responding to and servicing requests for data, linking clients needing additional information to experts and custodians, and collecting fees. Data providers must be informed of the CGKN initiative, understand its products and services, and communicate this information to clients.

Survey Staff

Survey staff can be both data creators and users who play a key role in defining the geoscience data management requirements. Based on their experience of client needs and in-depth geoscience knowledge of their jurisdiction, these staff members form part of the steering committee and working group committees within the CKGN.

Survey Managers

Survey organization managers provide the high level guidance and direction that defines the mandate and role of the participating survey within their jurisdiction. These managers form the core of the National Geological Surveys Committee that sets the national geoscience agenda by drawing together the common goals and requirements of all jurisdictions. Managers and directors have a responsibility to ensure their staff conform to their agencies policy on participation in the CGKN.

4.2) Clients

Clients, both internal and external, are the driving mechanism for the design of the interface and delivery profile of the CGKN. Clients create the profile of products derived from the CKGN information store.

Traditional Clients

Traditional clients include the mining and exploration industry, consultants, and service organizations that use geoscience knowledge to make decisions and plan

strategies. The needs of these clients are well understood and the CGKN will be designed to meet the needs of this client group.

Survey Management

Survey managers are clients who typically require generalized information in a form that can be integrated with current agency program and project planning data. The CKGN will ultimately support dynamic generalization of information and be able to deliver up-to-date information on the status of geoscience knowledge in Canada

Specialist/Scientific Users

Scientific users are likely to require access to raw or processed data and typically understand the data. The CGKN will allow scientists to discover knowledge and then, either link them to the corresponding custodian and source, or deliver the data in a form customized to meet their needs. CGKN delivery mechanisms will be designed to accommodate expert client requirements for specific formats, resolutions, and projections.

Resource Exploration Community

The resource exploration community is a primary and traditional NGSC client. The needs of the community are well understood and the CGKN will be designed to ensure its needs are met. Specific requests by companies may require specialized processing of the geoscience information that will be best accommodated through direct communication with NGSC agencies.

Non-specialist Users and the General Public

The general public can be made more aware of earth sciences through the CKGN. Specialized web sites that provide simple and relevant information (generalized geology, interactive demos, remote sensing, educational resources, etc.) can help educate the public about the role of geoscience in providing essential information on issues such as climate change, sustainable resources, and health and safety. Non-specialist users will be more interested in viewing derived products where CGKN knowledge is customized for their application possibly through integration with other CGDI data sets.

5) Costs and Benefits

Since participation in the CGKN will require scarce agency resources, NGSC agency managers must be convinced that CGKN costs are justified by the benefits. Since Internet knowledge networks are new, one cannot determine the costs and benefits based on previous experiences. The problem is not unlike demonstrating the benefits of email when it first became available.

There is abundant evidence that all sectors of the economy are embracing e-business as the future. Around the world, governments at all levels are pushing forward with

development of systems to deliver integrate services and data through the Internet. There is a serious risk that if the geoscience community does not participate more actively, it will be left behind. The real question may be whether we can afford not to implement the CGKN.

Neither the overall cost of implementing the CGKN nor the total cost to each agency can be accurately specified at the outset. This is because the CGKN will achieve its vision through an incremental and phased implementation approach that allows agencies to decide on their degree and rate of participation. For each CGKN component project, the costs and benefits of participation will be clearly identified in the proposal for that project (Appendix D). In this way participating agencies will be able to control their annual costs and commitment.

Furthermore, the CGKN team will attempt to obtain funding support for CGKN projects from sources external to NGSC agencies, such as GeoConnections. These funding sources typically require project participants to lever their funds through matching in-kind or cash contributions. Collaborative national initiatives such as the CGKN are more likely to be successful in obtaining project funding from these large national programs than individual agencies.

One can predict many benefits of the CGKN:

1) Cost Savings:

- Reductions in costs through co-operative development of standards, tools and systems for building, managing and capturing geoscience information.
- reductions in costs related to supporting client data discovery
- reductions in costs related to data reformatting for integration or interpretation
- reductions in the cost of responding to client inquiries

1) Marketing:

- Clients will be able to easily discover, evaluate, and contact data providers, through a single CGKN Internet portal and be directed to the appropriate agency.
- Conformity to international and CDGI standards will ensure that agency knowledge can be discovered through other geospatial portals and search engines.
- International clients entering through the “Canadian” CGKN portal will be linked to agency web sites and data sources.
- Enabling data discovery and evaluation through CGDI services will increase public awareness and understanding of the importance of geoscience.

3) Improved Service to Clients

- Clients will be able to obtain geoscience data products from NGSC agencies that are significantly more consistent in format.
- Incremental adoption of CGKN standards and systems based on a prioritization of CGKN needs by NGSC member agency will result in a system that will meet agency needs and takes advantage of evolving Internet technology.

- Commercial software developers will benefit from being able to develop applications for a limited number of-CGKN compliant data formats.
- Improved data consistency and accessibility will encourage creation of value-added products based on NGSC data by consultants and non-traditional clients.

4) Improved Competitiveness

- The resulting network of geoscience information will put the provinces and the nation in a global leadership role. This competitive edge will encourage resource exploration investment based on the availability of accurate and timely geoscience information.
- NGSC agencies will become recognized as world leaders in the integration of geoscience information potentially resulting in international technology transfer contracts.

6) Development Guidelines

- The CGKN will be developed through a phased approach addressing in order of priority, discovery, evaluation, and access. Agencies will be given an opportunity to participate in development on all CGKN project proposals.
- Wherever possible CGKN systems, tools, and methodology will be non-intrusive and integrate with the existing systems, standards, and methodologies used by NGSC agencies.
- Each geological survey will participate in the CGKN at its own rate and fund its own activities, manage and maintain its information holdings locally, and decide on priorities for incorporation of its information into the CGKN.
- Key data sets for which the CGKN will provide consistent national coverage must be identified through a process of consultation involving the surveys and both traditional and potential users of geoscience information. Preliminary surveying indicates key CGKN data types are: bedrock geology, surficial geology, geophysics, geochemistry, and mineral deposits. The many other types of geoscience data will be incorporated as resources permit.
- The CGKN will adopt existing international standards, protocols, data models, and methodologies for incorporation of important data layers in CGKN. This approach will ensure compatibility between the CGKN and other international initiatives and allow the CGKN to evolve to meet future needs, and to adapt to technological change. Standards will be adopted in response to both immediate need and long term goals, rather than developed for their own sake.
- The CGKN is a National Geological Surveys Committee initiative. The NGSC will approve a CGKN management structure and assign responsibilities within that structure. One NGSC member will be designated to be CGKN Executive Champion and will be responsible for tabling CGKN recommendations, progress reports, and project proposals at NGSC meetings.

7) Implementation

7.1) Phasing

The CGKN will achieve its objectives through a process of phased development addressing the user's need to discover, evaluate, and finally access geoscience data. Details on current projects can be found in Appendix D.

a) Discovery

User needs to "Discover" data will be supported by providing the user with on-line tools to search the metadata catalogues of NGSC member agencies. The existing "CGKN Publications Directory" (<http://cgpd.cgkn.net>) online catalogue of NGSC *products and publications*, which is searchable through CGKN and CEONet, has been on-line since 1998. This service is being expanded to include metadata describing key NGSC geospatial *data* through the "CGKN on-line data Catalogue" project (Appendix D) funded by NGSC agencies and NRCAN's Targeted Geoscience Initiative. A survey of NGSC agency metadata readiness was completed in the Fall of 2000 and resources have been allocated to NGSC member agencies based on an analysis of this survey. If existing funds are inadequate to complete metadata creation for all NGSC data, GeoConnections funds may be requested to lever expansion of the metadata catalogue.

b) Evaluation

User "evaluation" of geoscience data will be supported through on-line services that display images of individual data products. Enabling evaluation, integration, and visualization of NGSC data through CGKN and CGDI services is a top priority for the CGKN. Internet map server technology (preferably Open GIS Consortium-compliant) will be used to support on-line viewing of imagery created through integration of CGKN data from distributed and NGSC sources. The CGKN has determined that the highest priority data types are bedrock geology, surficial geology, geophysics, geochemistry, and mineral deposits. Discipline-specific working groups will identify key deliverables and services related to each data type and then collaborate on standards and infrastructure that will support integration and evaluation. Since NGSC agencies currently utilize diverse terminology and data formats, agreement on a level of common terminology will be essential to achieve interoperability. Definition of standard terminology is necessary for data model implementation and establishment of standard file formats for data transfer.

c) Access

Once users have discovered data and evaluated their suitability for their application, the final step is to "access", or obtain, the data. Providing access to all NGSC data, in interoperable form, is a long-term goal of the CGKN. Initially, The CGKN will facilitate access to data by providing links to existing agency sources. Methods for direct access to data through CGKN and CGDI will be

investigated. A short-term solution for data exchange may be definition of a standard data file format. As consistent national data sets become available through CGKN, generalized geoscience layers will be prepared for delivery through the National Atlas and GeoGratis.

7.2) Interoperability

CGKN participants agree that establishment of certain core standards for geoscience data is essential for the CGKN to achieve its ultimate goal of providing Internet access to consistent and interoperable NGSC data. The CGKN Geoscience Data Infrastructure Working Group was established in 1998 to work on identification and definition of the standards required by the CGKN. Through regular federal-provincial teleconferencing and a national workshop in June 2000, an approach to standards definition has evolved.

Since NGSC agencies have, to varying degrees, developed and implemented information management systems and standards to meet their local needs, agency data sets are inconsistent in terminology, structure, and format, which hinders achieving the interoperability required for the CGKN to reach its goals.

The simple, but unrealistic, solution would be for the CGKN to define standards for all geoscience data and recommend that NGSC agencies develop compatible systems based on these standards. This “tightly-coupled” approach to interoperability is not practical for NGSC agencies because they have different local requirements and the resources required to fund this significant data and systems conversion exercise cannot be justified by the expected benefits. An alternate “loosely-coupled” approach involves establishment of a standard format for data exchange. This simple approach may be practical in the short term, as it would provide many of the benefits of interoperability without requiring agencies to modify existing systems and standards.

A more elegant solution involves a process of dynamic translation from agency data into a standard CGKN Model. NGSC agencies are currently participating in development of a comprehensive geoscience data model through the NADM Initiative (Appendix B). A project to integrate bedrock geology data from several agencies has been proposed. This project will achieve interoperability through dynamic mapping of distributed agency data into a common model based on selected standards, including components of the NADM.

7.3) Standards

Wherever possible the CGKN will adopt existing national and international standards rather than developing new standards. The CGKN has adopted CGDI standards for metadata (FGDC) and online searches (Z39.50). Other standards that must be defined are geoscience content standards and geospatial and Internet mapping standards. To ensure compatibility with CGDI services, the CGKN must conform to CGDI standards for Internet mapping. Where possible, open geospatial standards, from organizations such as the OpenGIS Consortium, are preferred.

Geoscience content standards are largely a scientific issue and are being addressed through the NADM (Appendix D) and CGKN initiatives. As the NADM and other standards and tools become available, they will be evaluated for CGKN use. As the NADM model and related tools and standards evolve, the CGKN must move forward with phased delivery services. Development of a standard, system-independent format based on XML may provide a short-term solution for the transfer of data between agencies and users. XML is currently the preferred technology for system independent Internet data transfer. The CGKN will participate in international initiatives to develop a standard geoscience XML (geoXML).

8) Management Structure and Accountability

National Geological Surveys Committee

The CGKN is an initiative of the National Geological Surveys Committee (NGSC). The NGSC has delegated responsibilities for CGKN development and coordination to the Steering Committee and Secretariat. One member of the NGSC is the CGKN Executive Champion, responsible for coordination between NGSC and the Steering Committee and Secretariat

The CGKN Steering Committee

The Steering Committee is composed of representatives from all NGSC agencies and is responsible for making recommendations to the NGSC on the goals, objectives, and priorities for the CGKN.

The CGKN Secretariat

The 3-person Secretariat is responsible for coordination of CGKN activities and projects, liaison with GeoConnections, marketing and communication, maintenance of the CGKN Home Page, and CGKN financial administration. The Secretariat is currently composed of John Broome (GSC), James Rupert (GSC), and a rotating provincial member, currently Eric Grunsky (AGS). The Secretariat reports to both NGSC and the Steering Committee.

The CGKN Geoscience Data Infrastructure Working Group

The Geoscience Data Infrastructure Working Group is responsible to advising the steering Committee, the Secretariat, and CGKN participants on technical and scientific issues related to CGKN development. Membership is open to all interested parties. The Geoscience Data Infrastructure Working Group is responsible for establishing and coordinating the activities of the discipline working groups.

Discipline Working Groups

Discipline working groups are responsible for making recommendation on technical, standard, and scientific issues for that a particular discipline. Currently five key geoscience disciplines have been identified; bedrock geology, surficial geology, geophysics, geochemistry, and mineral deposits. A sixth working group will address

issues specifically related to establishing common elements and related standards that are required to facilitate integration of different data types.

9) Marketing and Communication Strategy

Marketing and communication will consist of directing information to the stakeholders and clients of the CGKN. Extensive communication is extremely important in collaborative projects such as the CGKN. Communications fall into four categories:

- 1) High level information for senior management and the NGSC about the goals and progress of the CGKN.
- 2) Technical and coordination information describing CGKN progress and initiatives for the CGKN Steering Committee.
- 3) Marketing and communications information to clients and stakeholders conducted primarily through electronic communications and workshops consisting of technical reports on the progress and issues around the practical implementation of the various aspects of the CGKN.
- 4) Marketing to CGKN services to potential users of the CGKN.
- 5) Client feedback

Regular updates on the progress of the CGKN will be prepared by the Secretariat that include:

- 1) Brief summaries of meetings and workshops at all level of the CGKN initiative.
- 2) Notices of milestones/achievements of various participating agencies and/or CGKN projects,
- 3) Information on similar national and international initiatives (USGS, Australia, GEIXS, etc.)
- 4) Information and URL's for the various agencies and their developing web sites.
- 5) Information on the commercial vendors who are involved in the development of the CGKN

Initial marketing efforts will focus on educating potential users on how the CGKN can help them to obtain geoscience information. Publications in appropriate newsletters and journals (i.e. Geoscience Canada, Geotimes, GEOLOG) and brochures will be used to increase awareness and usage of the CGKN. Displays and demonstrations at trade shows and workshops will also be used for marketing.

Additional marketing efforts may focus on encouraging members of the geoscience community outside of the NGSC to adopt the CGKN model for managing and disseminating geoscience information. The minerals and oil and gas exploration industry, academic institutions, and other non-NGSC government agencies will be encouraged to adopt or adapt CGKN protocols. This would encourage the broader development of common exchange formats and integrated delivery of geoscience information.

10) Performance Measurement

Some aspects of overall CGKN performance can be measured easily through simple quantitative measurements such as:

- 1) Measuring usage of CGKN Internet sites and the demographics of that usage,
- 2) Measuring the percentage of NGSC data that can be accessed in CGKN compliant form through CGKN services and the CGDI.
- 3) Measuring referrals, linkages to agency web sites, product requests, and data sales through CGKN services.
- 4) Monitoring the use of CGKN services for exchange of data between and within NGSC agencies.

The performance of specific CGKN services, such as the On-line Data Catalogue, can be measured using inexpensive commercial software that can provide comprehensive statistics and information on usage patterns and client preferences.

It will be difficult to provide immediate measures of some aspects of CGKN performance and impact. For example, measurement of a generalized increase of geoscience awareness by the public will be difficult although web site statistics may provide an indirect measure.

Increases in geoscience data usage resulting from the CGKN will be more difficult to measure as the agency statistics for past and current usage by different client groups are highly variable.

On-line questionnaires and direct email surveys will be used to monitor client satisfaction and obtain information on potential improvements to CGKN services. Where new or significant user groups or uses are identified, direct follow up with users will be used to provide information on the suitability of CGKN services for that client group. This information that can be fed back into CGKN development to enhance CGKN services to better meet the needs of the new clients.

11) Risk and Mitigation

1) Risk: Lack of Sustainability

A principal risk for the CGKN, and the CGDI, is sustainability after development funds no longer exist. There are significant costs associated with CGKN participation for each agency and the benefits of participation must be clear.

Mitigation:

NGSC agencies have documented their commitment to the CGKN as a group at NGSC meetings as well as individually. Most agencies are already making substantial investments in IM and Internet access systems. The CGKN will allow these agencies to coordinate their work and resources for maximum benefit

2) Risk: CGKN obsolescence due to evolution of standards and technology.

The Internet and its associated data standards, technology, and protocols are in constant evolution. There is a risk that the standards and systems adopted by the CGKN may not allow the CGKN to follow future evolution and as a result it will become obsolete.

Mitigation:

Wherever possible, the CGKN will base its design on existing national and international standards. CGKN participants are actively monitoring and participating in development of international geoscience content and language standards and aligning the CGKN to ensure compatibility. Where possible, Internet and geomatics standards will be those selected by the CGDI. Open standards such as ISO, FGDC, and Open GIS are preferred.

3) Risk: Inadequate CGKN content.

The CGKN can only be successful if it can provide access to a substantial volume of Canadian geoscience data. If agencies do not integrate a significant percentage of their knowledge holding into the CGKN, CGKN services will not be able to provide comprehensive information.

Mitigation:

The CGKN Online Data Catalogue will complete metadata creation for key NGSC geoscience data sets. NGSC agencies have been using digital methodology for some time to produce maps and distribute data. The issue will be not so much one of lack of content as the diversity of content. During the evaluation phase of development, the CGKN will concentrate on the standards and tools required for integration and interoperability of NGSC content.

4) Risk: Clients are not ready to use online services.

If NGSC clients are not ready to use or are unable to use CGKN services due to the technical requirement, then the initiative will not be accepted.

Mitigation:

Clients have shown an increasing preference for products in digital form. Usage of the CGKN Publications Directory is increasing. The CGKN will take action to increase usage by actively market its services to both existing and potential new clients and by providing training and support for new users.

5) Risk: NGSC agency data holding do not become interoperable.

If acceptable standards for scientific terminology are not adopted, it will not be possible to integrate data sets online from different agencies through the CGKN.

Mitigation

Interoperability can be achieved using a range of approaches. Through the NADM initiative and other international collaborations, accepted standards for geoscience data are becoming established. CGKN participants are active participants in the Science Language Technical Teams (NADM) that will define a standards geoscience language for geoscience data. Definition of a standard exchange file format is possible using a geoscience version of XML(geoXML) is a simple, inexpensive, and non-intrusive technical solution to interoperability

1) Risk: Agencies cease to participate in the CGKN.

CGKN agencies have different states of readiness for the CGKN, different priorities, and different policies regarding data access and pricing. If some agencies perceive that they are not benefiting from the CGKN, there is a risk that these agencies will drop out.

Mitigation

The CGKN must be implemented in a flexible and non-intrusive manner that allows agencies to retain control their rate of participation and obtain solutions that meet their needs and capacity. For example, agencies with less advanced information management and delivery systems will benefit from the availability of common CGKN tools and standards. -Those agencies with more advanced systems will be able to take early advantage of the marketing and delivery applications of the CGKN, and focus on the development of more advanced aspects of the CGKN.

Appendix A: List of Participating Agencies and Representatives

Territorial Agencies

Yukon	Gord Nevin, gord.nevin@gov.yk.ca
Northwest Territories	Beth Sage, sageb@inac.gc.ca
Nunavut	Celine Gilbert, cgilbert@NRCan.gc.ca

Provincial Agencies

British Columbia	Don MacIntyre, Don.MacIntyre@gems1.gov.bc.ca
Alberta	Eric Grunsky, Eric.Grunsky@gov.ab.ca
Saskatchewan	Bill Slimmon, Bill.Slimmon@sem.gov.sk.ca
Manitoba	Len Chackowski, Lchackowsk@em.gov.mb.ca
Ontario	Franco Merlino, franco.merlino@ndm.gov.on.ca
Québec	Charles Roy, charles.roy@mrn.gouv.qc.ca Jean-Marc Charbonneau, jean-marc.charbonneau@mrn.gouv.qc.ca
Nova Scotia	Brian Fisher, befisher@gov.ns.ca
New Brunswick	Paul Rennick, prennick@gov.nb.ca
Newfoundland	Larry Nolan, lrn@zeppo.geosurv.gov.nf.ca

Geological Survey of Canada

GSC - Atlantic	Phil Moir, pmoir@NRCan.gc.ca
GSC - Québec	Éric Boisvert, eboisvert@NRCan.gc.ca
GSC - Ottawa	Andrew Moore, amoores@NRCan.gc.ca John Glynn, glynn@NRCan.gc.ca (ESS-Info) John Broome, broome@NRCan.gc.ca Boyan Brodaric, bmb184@psu.edu (Penn State University)
GSC - Calgary	Peter Davenport, pdavenpo@NRCan.gc.ca
GSC - Pacific	Murray Journeay, mjournea@NRCan.gc.ca Bert Struik, bstruik@NRCan.gc.ca

Appendix B: Related Initiatives

GeoConnections

Within Canada, the GeoConnections Initiative (<http://geoconnections.org>) has been established to develop the Canadian Geospatial Data Infrastructure that will integrate Canada's numerous geographic information sources and provide Canadians with Internet access to geospatial services and information. GeoConnections is also enabling partnerships between federal, provincial and territorial governments, the private sector, and the academic community aimed at harmonizing Canada's geospatial databases, including topography, aerial photography, satellite imagery, nautical charts, and census maps. The CGKN is envisioned as the geoscience node of Canadian Geospatial Data Infrastructure.

Targeted Geoscience Initiative

The Targeted Geoscience Initiative (TGI) is a three-year, \$15 million federal program to promote mineral and hydrocarbon exploration in Canada. The goal of the Targeted Geoscience Initiative (TGI) is to turn resource potential into new social and economic benefits by increasing the level and effectiveness of private sector mineral exploration. In particular, it will help ensure that Canada's geoscience information infrastructure continues to be state-of-the-art. By improving the quality and quantity of geoscience information available and promoting its rapid dissemination on the Information Highway, the TGI will help stimulate new investment in the mining sector. The two principal TGI program elements are integrated geoscience mapping and digital data capture, analysis and dissemination. If Canada is to remain competitive in the increasingly global mineral exploration market, there must be virtually instantaneous access to our exploration-related geoscience information from anywhere in the world. Moreover, diverse data must be provided in a way that it is readily integrated and analyzed. To help get Canada's geological survey data "on-line", the TGI will make strategic investments to build components of the Canadian Geoscience Knowledge Network (CGKN).

North American Data Model Initiative

The goal of the North American Data Model Initiative is to develop a comprehensive data model for the management of geoscience data. Canadians are actively collaborating with United States Geological Survey and American state geological surveys in the design and testing of the North American Data Model or NADM (<http://geology.usgs.gov/dm/>). The CGKN Data Model Working Group is coordinating Canadian activities and participation in NADM development. This role includes extension and testing of the model in a distributed multi-agency environment, participation in NADM Science Language Technical Teams, and development of a user-friendly tool, called GEOMATTER, to facilitate loading geological map data into the North American Data Model.

Appendix C: Glossary

CDGI

The Canadian Geospatial Data Infrastructure, which is being developed by GeoConnections, will coordinate Canada's numerous databases of geographic information, make them accessible through a common window on the Internet, and enable partnerships between federal, provincial and territorial governments, the private sector and the academic community.

CGKN

The Canadian Geoscience Knowledge Network is an initiative of the National Geological Surveys Committee to provide Internet access to consistent Canadian government geoscience data.

CEONet

CEONet is the prime discovery component of the CDGI to support access to geospatial information and services.

FGDC

The Federal Geographic Data Committee is an American initiative to establish the standards, policies, and framework for geospatial data management in the United States.

GEIXS

A Eurogeosurveys (European union of National Geological Surveys) project that provides an on-line European Geological Data Catalogue

GeoConnections

GeoConnections is a national initiative to develop the Canadian Geospatial Information Infrastructure (CGDI).

GeoGRATIS

GeoGratis distributes a wide variety of geospatial data, data based on location, for geographic areas across Canada. The objective of GeoGratis is to expand the use of geospatial data to new user communities through the distribution of intuitive data types and encourage geomatics research, development and education by providing high quality Canadian data sets. The data is available free of charge, subject to copyright restrictions and disclaimer.

GeoInnovations

GeoInnovations is a GeoConnections program that provides seed funding or funding support for innovative geospatial infrastructure projects developed by Canadian companies

GeoMatter

A software tool for population of NADM-compliant databases

GeoXML

A variant of XML for geoscience data exchange on the Internet

GIS

Abbreviation for Geographic Information System,

IGA

The Intergovernmental Geoscience Accord is a agreement that describes the nature of federal, territorial, and provincial geoscience collaboration

IM

Information management

Interoperability

The state where data can be exchanged without loss of content or understanding

ISO

International Standards Organization

IT

Information technology

NADM

North American Data Model. An initiative of the USGS, the GSC, American state and Canadian provincial geoscience agencies to establish a standard model for geological map, and ultimately all geoscience data.

National Atlas

The National Atlas of Canada is a source for Canadian map products and data. It is being developed in partnership with organizations that hold scientific data and knowledge. The information portrayed in the National Atlas of Canada helps to explain the social, economic and biophysical make-up of Canada and packages the information in terms of issues and challenges that face our country.

NGSC

The National Geological Surveys Committee coordinates the activities of the 12 federal provincial and territorial geoscience agencies in Canada.

OGC – see OpenGIS (below)

OpenGIS

The OpenGIS Consortium (OGC) is developing open software independent standards and protocols for GIS data and software

TGI

The Targeted Geoscience Initiative is a federal program designed to stimulate new investment in the mining sector by improving the quality of information relevant to new mining opportunities.

XMML

A CSIRO (Australia) initiative to develop an XML dialect for mining geoscience data
<http://www.ned.dem.csiro.au/research/visualisation/XMML/>

XML

Extensible Markup Language: a simple ASCII markup language based on the use of <tags> for transfer of data on the Internet.

Z39.50

A standard Internet search protocol

Appendix D: Current Projects

a) Web Site and Portal

Description

A CGKN Home Page (<http://cgkn.net>) has been established as a source for information on CGKN initiatives, workshops, committees and working groups, and a link to CGKN services. As CGKN evolves, it will co-exist with CGDI services as a national portal for NGSC agency geoscience knowledge.

Deliverables and Milestones

Currently on-line, continuous maintenance and improvement

Agency Resource Implications

None (maintenance by CGKN Secretariat)
GSC server SW and HW

b) CGKN Online Data Catalogue

Description

The CGKN On-line Data Catalogue project was started in July 2000 and will be completed in 2002. The goal of the project is to facilitate discovery of geoscience data and publications available from Canadian government geoscience agencies. During their history, geological surveys have invested vast sums of money in the collection of large volumes of geoscience data and generation of interpretations of these data. By developing a complete and accurate on-line catalogue of Canadian Government geoscience data, explorationists and geoscientists will be able to easily discover available geoscience data through CGKN and CGDI (CEONet) search tools. The catalogue will also direct users to the NGSC sources for the data. This project will make Canada a more attractive mineral exploration target to both national and international companies by providing access to information that communicates the relative mineral potential of areas, aids in exploration planning, and communicates the existence of inexpensive data that can aid in exploration.

This project is being funded by NRCan's Targeted Geoscience Initiative and NGSC agencies. The project methodology was discussed extensively by the federal-provincial CGKN Steering Committee and at the 2nd CGKN national workshop in Calgary, June 4-5, 2000. Consensus was reached at the workshop that the project should be directed by a 6-member federal-provincial Project Working Group. The working group will ensure the on-line catalogue can be sustained into the future and the design is both extensible and can be easily modified to accommodate future needs. Through liaison with CGKN participation, the working group will ensure that common subject classification systems are adopted both for CGKN discipline data models and the data catalogue. Close liaison

with GeoConnections will ensure that the catalogue is interoperable with CEONet and other CGDI systems.

The following 3 principal subprojects were identified at the 2nd CGKN Workshop.

- a) Clear definition of the scope of the catalogue and implementation in a minimal CGKN metadata model, based on the FGDC/ISO standard, that will allow data to be discovered but not require excessive resources to create the metadata.
- b) Each agency will receive support to upgrade/create metadata conforming to the CGKN metadata profile based on demonstrated need.
- c) Implementation of an Internet web site that allows users to search the data catalogue by text string or geographic area. This web site would also include the functions of the existing NGSC Canadian Geoscience Publications Directory.

Principle Deliverables and Milestones

<u>Deliverable</u>	<u>Completion date</u>
1 CGKN profile for NGSC metadata	(completed) Sep.15/00
2 Catalogue population tools	(ongoing) Oct. 15/00
3 Survey of agency metadata readiness	(ongoing) Dec. 15/00
4 Agency metadata catalogues completed	Sep.30/01
5 Limited betas release of service	Sep. 30/01
6 Connection of catalogues to CGKN/CGDI	Oct.30/00
7 Service online/project completed	Dec. 31/01

Resource Requirements

Total project cost	\$1095K
Targeted Geoscience Initiative support	\$525K
Agency in-kind support	\$570K

Agency Contributions:

NGSC agencies will make in-kind contributions through participation in establishment of a CGKN geoscience metadata standard, completion of a metadata readiness survey, preparation/supervision and Internet enabling of metadata. NGSC agencies will maintain their metadata and connectivity after end of project.

The GSC will provide project leadership through the CGKN Secretariat, develop and implement the discovery engine, and supply and maintain the server.

c) GeoInnovations Projects

Through the GeoInnovations program funding support, NGSC agencies have, and continue to participate with the private sector in a number of projects to develop for innovative geospatial infrastructure components required for CGKN, geoscience data management and Internet delivery. Examples include, a project involving Global Geomatics and the GSC to developing server-based GIS functionality to complement the

OGDI standard and a project involving Holonics and Cubewerx to implement a geoscience data warehouse at the GSC. A recently approved project between GeoArctic International, the GSC, and several northern geoscience agencies will implement a system for web-enabling Eastern Arctic Geoscience Data.

Appendix E: CGKN Workshops

First Canadian Geoscience Knowledge Network Workshop (Dec. 1998)

In 1998, a national workshop was held to establish the overall CGKN vision and guidelines and develop a preliminary implementation plan. Representatives from all twelve Canadian government geoscience agencies attended the workshop. The process involved consideration of content, structure, standards, management, funding and an investigation of how federal, provincial, and territorial agencies could cooperate on its development.

There was agreement that workshop was an outstanding success and the resulting CGKN concept received strong support from all participants. In addition to an investigation of the technical and policy issues, a preliminary CGKN management structure was developed and a number of actions were defined to move forward with the initiative. The results of the workshop will be compiled in report form and define the core of the CGKN vision.

Second Canadian Geoscience Knowledge Network Workshop (June 2000)

In 2000, a second national workshop was held to sharpen the CGKN vision and guidelines, decide upon the optimal use of available and anticipated funding, and investigate current agency data management and modeling practices. Primarily IM/IT specialists attended this meeting.

Executive Summary from Workshop Report

The workshop confirmed the importance of the goals of the Canadian Geoscience Knowledge Network initiative (CGKN), which are to develop and implement methods to make the geoscience data holdings of the Federal, Provincial and Territorial Surveys of Canada interoperable, and to provide access to these data through the Internet. The need for a geoscience data model was also recognized as central to achieving these goals. In the context of this workshop, “data model” means the grammar and vocabulary required to facilitate the discovery, mutual understanding and exchange of geoscience data.

There were three facets to the workshop:

- a) presentations on the goals of CGKN, on geoscience data modeling and on the solutions some agencies are already implementing within their own jurisdictions;
- b) a consultant’s review of the current status of geoscience data management in Canada’s geological surveys, and recommendations on how these could be built upon to meet CGKN goals; and
- c) intensive discussions in plenary and breakout groups to formulate plans to enhance and reinforce current practices of data management to meet both agencies’ internal objectives and the CGKN vision of a national infrastructure of

interoperable geoscience data. There was a considerable degree of congruence in the views expressed in the three facets of the workshop.

The main recommendations from the workshop are as follows:

The data model be built in discipline-specific components as dictated by the diversity of geoscience data types, drawing on specialists in the various sub-disciplines to guide the terminology (science Language or vocabulary) and functionality (grammar or relationships between data elements) for each component. The priority disciplines are geology (bedrock and surficial), mineral deposits, geophysics and geochemistry. Some work is already underway in individual agencies. This work should be fostered, better coordinated and will require new multi-year funding.

Overall development of the common geoscience data model be coordinated by a team dedicated to this task to ensure interoperability between the discipline-specific components and to eliminate redundancy and duplication between them. This team would also develop interoperability standards and exchange mechanisms between the common data model and the data models used by participating agencies. This work is longer term, but vital to the sustainability of the whole project, and a three-year funding commitment is needed to allow it to proceed expeditiously.

A comprehensive catalogue of Canadian government geoscience data and publications be developed, together with an Internet search engine to allow their discovery. The search engine should allow user-specified text or geographic searches of the catalogue and direct the user to the sources of discovered data. This catalogue was identified as the obvious first step for CGKN, and should be funded this year (2000).

CGKN be managed by a permanent program office of two or three full-time staff with recognized expertise in geoscience information management. Its functions would include developing a vision and business plan for CGKN in consultation with the National Geological Surveys Committee, establishing an effective communications plan, including a Web site, publishing the work of the data model teams, and seeking out and administering funding to build CGKN. This office should be in place by October, 2000.

The complete implementation of CGKN will allow our clients to realize the full potential of IT to reveal new insights that will lead to both more efficient resource development and better environmental stewardship. There is some urgency to do this if Canada is to maintain its competitive position internationally. The task will require a major commitment of resources by all agencies, although many have indicated that at present this will be difficult given their current fiscal positions. Even so, the availability of funding from national programs such as the GeoConnections and the Targeted Geoscience Initiative do offer the opportunity to start work on all the above recommendations. Producing an agency-wide of data holdings will likely be an early project, achievable within the near term. For the data model design and population, initial steps may involve pilot projects between the GSC and some interested provincial and territorial agencies to address specific geoscience data holdings within the four

priority sub-disciplines. By sharing the technology developed in this initial work, its implementation across all agencies should be significantly easier, more rapid and less costly.