Business Plan for Development of Regional Geopositioning Cooperative for Idaho and Montana

Business planning addressing goals of the FGDC 2011 Category 4 Cap Grant Award for Multi-State Planning and Implementation of Geodetic Control Framework Components

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1. EXECUTIVE SUMMARY

This *Business Plan* is one part of a research and planning project supported by a Federal Geographic Data Committee (FGDC) Category 4 CAP Grant. The 2011 award was made to a multi-state team composed of private sector, government, and academic professionals from Idaho and Montana. The purpose of this plan is to define an approach for development and operation of a multi-state "Geopositioning Cooperative" (GC) which has two main components:

- Multi-state Control Point Database (MCPD) to provide efficient data entry and subsequent access to geodetic control information
- A global navigation satellite system (GNSS) real-time network consisting of high-precision base stations (e.g., CORS) and accompanying services to support real-time, Web-based positioning and location-based services— initially in Eastern Idaho and Western Montana with gradual expansion throughout the two-state region.

As described in this plan, the GC encompasses the facilities, personnel, and systems required to provide MCPD and real-time GNSS services. This plan presents a path for GC development that takes into account successes and lessons learned in similar successful operations in other states and which builds on significant work that has already been accomplished in building the two main GC components in Idaho and Montana. This plan is based on extensive information collected from a wide group of stakeholders, with multiple draft plan and review steps carried out between May 2011 and February 2012. It describes proposed GC resources and services, GC management and organizational structure as well as the tasks, timing, and resources needed for GC development—all of which are based upon a clear, long-term strategic foundation in the form of the following mission statement and high-level goals:

GC Mission Statement

> *Establish a sustainable geopositioning cooperative that serves the needs of the broad user communities of Idaho and Montana by providing effective access to high-quality geodetic control information, GNSS Infrastructure, and related services.*

GC Goals

1. Establish and maintain a physical facility with the necessary hardware, software, office space, and personnel to support GC services and activities.

2. Develop, deploy, operate and maintain a database and associated Web service for entry of and access to high-quality geodetic control information.

3. Support the establishment of a comprehensive network of stations providing GNSS data for real-time correction of locational data—including connections with stations operated by multiple public sector, private sector, university, and other organizations.

4. Coordinate activities and information sharing among a broad stakeholder community to improve collection of and access to geodetic control information.

5. Define and identify an organizational entity with an effective governance structure to manage and oversee the multi-state geodetic reference center and real-time GNSS services.

6. Identify sources and secure initial funding for development and ongoing financial support for long-term operations.

7. Help provide an environment for improved collaboration, communication, support, and sharing of best practices for geodetic control development and distribution.

8. Establish effective outreach, promotional tools, and activities to encourage and expand the user community and to sustain awareness of and active involvement in GC activities.

GC systems and services will build on programs already in place and which are currently being provided through the Idaho State University GIS Training and Research Center (GIS TReC) and the Montana Base Map Service Center (Montana State Library). As described in this plan, the GC will provide the following types of functions and services:

- Multi-State Control Point Database (MCPD) Operations
- RTN Set-up and Operations
- General assistance to the user community
- Liaison and Support to the NGS
- State GIS Program Support
- Special Projects
- Involvement in Academic and Research Activities

The plan calls for a phased approach for GC development during which time the GNSS RTN network will be expanded and a full range of services will be put in place. The following four phases are defined. Most of the GC development and deployment of systems and services will be in place at the close of Phase 3 (about 4 ½ years after plan approval) with additional expansion in Phase 4. Phases include:

- Phase 1: Initial MCPD Enhancement and Preparation for Geopositioning Cooperative (GC) Formation (6 months from *Business Plan* Acceptance)
- Phase 2: Initial Geopositioning Cooperative and RTN Set-up and Additional MCPD Enhancement (24 months following end of Phase 1)
- Phase 3: Expansion and Formalization of Geopositioning Cooperative Services and RTN (24 months following end of Phase 2)
- Phase 4: Mature Geopositioning Cooperative Services and RTN Operations (Future after Phase 3)

Implementation activities associated with the four recommended GC development phases are identified and described in the plan. These implementation tasks are organized under the following categories:

- OR: Establishment and Set-up of Organizational and Governance Structure
- FS: Securing and Sustaining Funding and External Support
- MC: MCPD Enhancement and Operations
- RT: RTN Technical Design, Development, and Operation of Services
- OP: GC Outreach, Promotion, and External Collaboration
- SP: Special Project and Service Delivery
- OM: Ongoing GC Management

Development and deployment of GC systems and services require staff and monetary resources much of which is not currently allocated. The plan identifies potential sources of funding as well as the need for active promotion and marketing. GC funding sources include monetary and in-kind contributions from lead and associate partners as well as subscription fees for GC users.

2. DEFINITION AND CONTEXT FOR GEOPOSITIONING COOPERATIVE AND GNSS NETWORK

2.1 Project Background and Purpose of the Business Plan

This *Business Plan* is one part of a research and planning project supported by a Federal Geographic Data Committee (FGDC) Category 4 CAP Grant. The 2011 award was made to a multi-state team composed of private sector, government, and academic professionals from Idaho and Montana. The project, being managed by the Idaho State University GIS Training and Research Center (see http://giscenter.isu.edu/research/Techpg/capGC/index.htm) demonstrates technical and governance approaches to support traditional geodetic control networks, as well as lower-order surveying control for cadastral, topographic, hydrographic, and facility mapping activities (herein referred to as geodetic data or geodetic control) in a multi-state environment.

A primary element of the project is the establishment of a service to support the discovery, use, and exchange of geodetic control information in Montana and Idaho. The result will be a Multi-state Control Point Database (MCPD) to provide efficient data entry and subsequent access to geodetic control information. A second goal that this planning addresses is the creation and ongoing operation of a real-time global navigation satellite system (GNSS) network consisting of high-precision base stations (e.g., CORS) and accompanying services to support real-time, Web-based positioning and location-based services— initially in Eastern Idaho and Western Montana with gradual expansion throughout the two-state region.

This *Business Plan* is being developed to guide the work associated with the programs and activities described above and, more specifically, the development and operation of a Geopositioning Cooperative (GC) to support various positioning projects and programs including hosting a Multi-State Control Point Database (MCPD) built on the foundation laid by the Montana Control Point Database, densifying the high-accuracy GNSS base station network and establishing a real-time GNSS network service. This *Business Plan* will address the governance, management, funding, and technical issues on which the GC depends and will define the implementation steps and timing for its development.

2.2 Status of Geopositioning Cooperative and GNSS Network Activities

2.2.1 Status of Activities in Idaho and Montana

Considerable groundwork has already been laid in Montana and Idaho for the development of a multi-state GC. This includes the development of the Montana Control Point Database and Web service currently maintained by the Montana State Library (see http://gisservice.mt.gov/MCPDviewer). This *Business Plan* calls for the expansion and enhancement of the database service to be renamed the Multi-State Control Point Database (MCPD) to serve the needs of users in Montana and Idaho. Since there are multiple organizations and efforts involved in collection and management of geodetic control data, this plan recommends a higher level of coordination and collaboration of these efforts. A summary of ongoing activities is provided in Table 1 below.

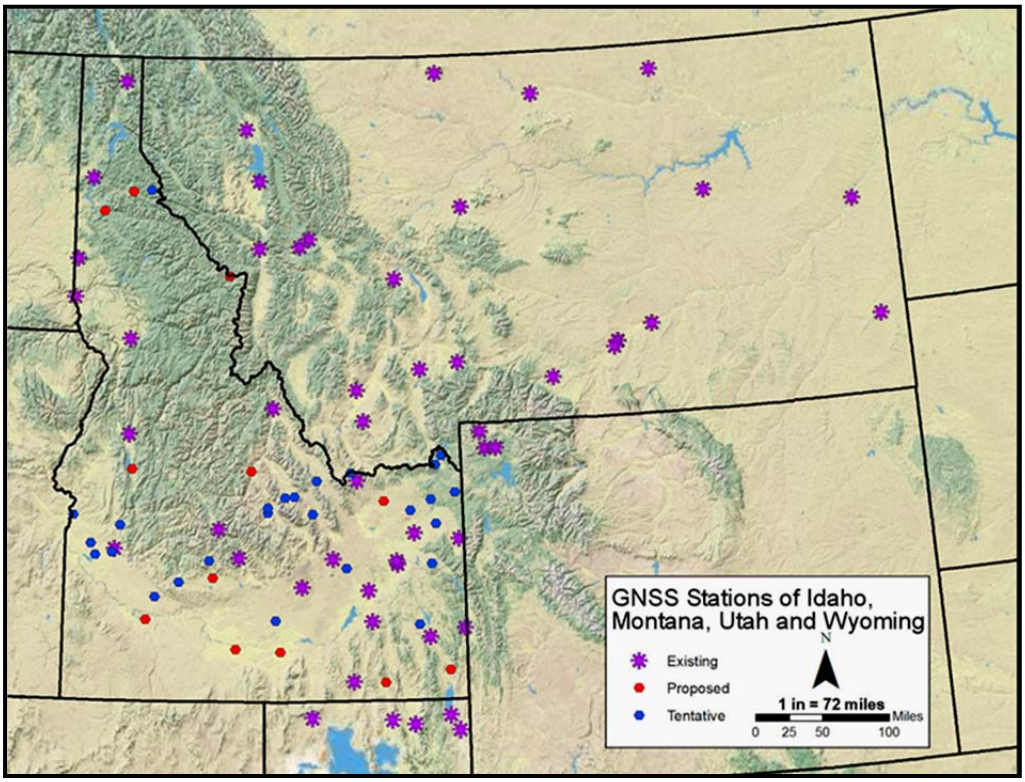
Table 1: Existing Geodetic Control Data Programs

Organization	Ongoing Programs and Activities for Geodetic Reference Data Management
Montana Control Point Database	This service currently collects and serves geodetic data for the state of Montana only. It is managed and maintained by the Montana State Library. Access service at http://gisservice.mt.gov/MCPDviewer.
Montana Department of Transportation (MDT)	The MDT collects and manages geodetic data for its own use. The MDT is investigating using the Multi-state Control Point Database for organizing, storing, and sharing geodetic survey data. MDT chairs the Montana Height Mod group. The Height Mod group is Montana's point of contact for CORS development.
Idaho Transportation Department (ITD)	ITD maintains 4 CORS stations and collects data continuously with data moved to an ftp server on an hourly basis. These stations are configured to provide data for the RTN managed at ISU. ITD districts collect and store control data for cadastral and right-of-way survey points but, for the most part, this data is not incorporated into the ITD GIS databases or is available for general access outside the ITD.
The Idaho Map/Geodetic Control Technical Working Group (GC TWG)	The GC TWG is focused upon the coordination of information relative to geodetic control across the state of Idaho and the potential for developing a statewide GNSS real-time network. No geodetic control data is being stored or gathered by the GC TWG.
National Geodetic Survey (NGS)	http://www.ngs.noaa.gov/. Currently provides nation-wide geodetic control information via ASCII text files containing data for survey control stations maintained and coordinated by NGS. Geodetic data collected by other entities is not available from this site.
The Idaho Map/Cadastral Reference Technical Working Groups (TWG)	This TWG focuses on enhancing and adjusting the CAD NSDI PLSS layer for statewide, multi-agency parcel mapping. This work cannot be accomplished without control point information. A centralized database would greatly enhance this group's efforts.
Geographic Control Database (GCDB)	Created and managed by the Bureau of Land Management, the GCDB is a collection of geographic information representing the Public Land Survey System (PLSS) and some Non-PLSS surveys of the United States. The GCDB grid is computed from BLM survey records. It is one source of PLSS control information, but contains only the points used to create the GCDB and is not an inventory of all points collected.
Farm Service Agency (FSA)/National Resource Conservation Service	Stores geodetic data provided by other entities as needed for the National Agricultural Imagery Program (NAIP). The information is not comprehensive or easily accessible. With a centralized control point database, FSA would be able to produce higher quality NAIP products.

There are many Federal, State, local government agencies and private companies which collect and manage geodetic control information for their internal uses but which are not currently providing an organized service for general access to the data or submittals from government or private organizations. Also, Idaho's Cadastral Reference Technical Working Group has access to several thousand control point records. Once permission has been obtained from the contributing surveyors, and the records have been converted to the correct format, submitting those records to a stable repository for storage and access will provide a great start for Idaho. One of the challenges and goals of the GC is to engage these groups and encourage participation in a regional program for geodetic control data submittal and access.

Currently there are no statewide real-time network solutions being developed for regional GNSS services in Idaho or Montana. There are base stations that operate independently and a few local single-base networks. Figure 1 shows existing and planned high-accuracy GNSS base stations in the region. These base stations, along with others to be built at a later time, will be connected together in a cohesive network to serve positional data to end-users in the field using modeled network solutions and integrity monitoring.

Figure 1: Existing and Planned High-Accuracy CORS Stations in the Idaho-Montana Region



2.2.2 Status of Similar Work in Other States

A number of other states or regional collaborations have set up centers and services to provide users with geodetic control information in a manner similar to that being proposed for the Idaho-Montana GC. In some cases, these services operate as separate "spatial reference centers" and in other cases operate as part of state geospatial data clearinghouse. In most cases the state department of transportation (DOT) or other government agency has taken the lead role in providing geodetic data. Several examples of successful operations are summarized below:

- The Utah Reference Network Global Positioning System (TURN GPS http://www.turngps.utah.gov/)
- Washington Spatial Reference Network (http://washington3d.org/)
- Oregon real-time GPS network (http://www.oregon.gov/ODOT/HWY/GEOMETRONICS/geodetic_control.shtml)
- California Spatial Reference Center (CSRC, http://csrc.ucsd.edu/) and Caltrans (DOT)
- Gulf Coast Geospatial Center (GCGC, www.gcgcusm.org/)
- Louisiana Spatial Reference Center (LSRC, http://c4g.lsu.edu/c4g15/)
- Texas Spatial Reference Center (TSRC, http://tsrc.cbi.tamucc.edu/) and DOT (http://www.txdot.gov/business/contractors_consultants/gps.htm)
- North Carolina Center for Geographic Information and Analysis, NCOneMap Program (www.nconemap.com/)
- New York State GIS Clearinghouse (http://www.nysgis.state.ny.us/gisdata)
- Illinois Natural Resources Geospatial Data Clearinghouse (http://www.isgs.uiuc.edu/nsdihome/)
- State of New Hampshire GIS Clearinghouse (GRANIT, www.granit.unh.edu/geodetic/datasheet)

The popularity and need for GNSS Real time networks has been growing rapidly across the USA and a number of local, statewide, and regional networks exhibit considerable success and growing demand. The USGS Water Resources Website (http://water.usgs.gov/osw/gps/real-time_network.html) identifies the active real-time networks shown in Table 2.

Table 2: Selected Statewide and Regional Real-time GNSS Networks in Operation
(Source: U.S. Geological Survey, http://water.usgs.gov/osw/gps/real-time_network.html)

Location	Network Name	Operated By	Contact
California	Orange County Real-Time Network (OCRTN)	County of Orange	http://www.ocgeomatics.com/Home/GeodeticControl.aspx
California	California Real Time Network (CRTN)	University of California San Diego / Scripps Institute of Oceanography	http://sopac.ucsd.edu/projects/realtime/
Iowa	Iowa Real Time Network (IaRTN)	Iowa DOT	http://www.iowadot.gov/rtn/
Louisiana	GULFNet	Center for GeoInfomatics - Louisiana State University	http://c4g.lsu.edu/joomla/index.php?option=com_content&task=view&id=12&Itemid=2
Maine	MTS RTK Network	Maine Technical Source	http://www.mainetechnicalsource.com/survey.htm
Minnesota	CORS/VRS Network	Minnesota DOT	http://www.olmweb.dot.state.mn.us/CORS.GPS/cors.html
Missouri	Midwest RTK Network	Seiler Instrument Company	http://www.mwrtk.net/
New Mexico	Real Time GPS Network	Vectors, Inc.	http://www.vectorsinc.com/
North Carolina	RTK Network	North Carolina Geodetic Survey	http://www.ncgs.state.nc.us/
Ohio	VRS RTK Network	Ohio DOT	http://www.dot.state.oh.us/Divisions/ProdMgt/Aerial/Pages/VRSRTK.aspx
Oregon	Oregon Real Time Network	Oregon DOT	http://www.theorgn.org/
South Carolina	Virtual Reference System	South Carolina Geodetic Survey	http://www.scgs.state.sc.us
Texas	RTK Network	Texas RTK Cooperative Network	http://www.txrtk.com/
Utah	TURN GPS Network	State Government (Automated Geographic Resource Center)	http://www.turngps.utah.gov/
Vermont	VECTOR	Vermont Geodetic Survey	http://vcap.aot.state.vt.us/CORS/vt-real-time.htm
Washington	Washington State Reference Network (WSRN)	Regional Cooperative	http://www.wsrn.org/
Wisconsin	WISCORS (Wisconsin Continuously Operating Reference Stations)	Wisconsin DOT	https://wiscors.dot.wi.gov/

This is only a partial list. Statewide RTN programs and services are also in place in Indiana, West Virginia, and other states. These statewide GNSS RTN programs provide a model for development in the Idaho-Montana region. Several examples of statewide RTN programs are summarized below:

- WISCORS (https://wiscors.dot.wi.gov/): Statewide network in development by the Wisconsin Department of Transportation (WisDOT) in partnership with other organizations (e.g., other state

agencies, local governments, universities, and federal agencies.) established through formal agreements. Includes permanent base stations placed at approximately 50 km spacing. Access to WISCORS data is open to any user who requests and receives logon information. User fees are being considered but currently, there is no charge for access.

- West Virginia DOT Real Time Network (wv.cors.us): The West Virginia Department of Transportation's Division of Highways (WVDOH) is responsible for maintaining and operating the Real Time Network (RTN) which consists of Continuously Operating Reference Stations (CORS) networked to create a dynamic geodetic reference system. CORS sites are owned and operated by a number of state agencies, research institutions, and private organizations. The Rahall Transportation Institute (RTI) is responsible for system design, CORS data collection, IT infrastructure, data processing, training, and technology transfer. RTI redistributes CORS static data for post-processing applications. The State of West Virginia operates the WVRTN to improve geodetic services to WVDOT and other State agencies but access is open to all users. Access to the WVRTN is provided free of charge at present, provided users complete the registration process and electronically acknowledge compliance with the end-user agreement.
- State of Washington Reference Network (www.wsrn2.org): The WSRN (Washington State Reference Network) is a regional cooperative of GPS reference stations and data that enables cost-saving solutions for public and private sectors in the fields of surveying, mapping, and other high accuracy location technology needs. GPS Data Files from a network of Continuously Operating Reference Stations (CORS) are available for download to all, with real-time services available through partnerships, memberships, and subscriptions. The WSRN2 website provides a rich set of data and services, user support, system status and monitoring reports, solutions and tips for users, and an open forum for users and other parties interested in real-time GPS. The WSRN is an integral part of the modernization of the Spatial Reference System for Washington State as the “active control” component; working with state and federal agencies, scientific and academic communities, as well as the geospatial communities of surrounding states and provinces. The operations of the Central Processing Center are funded mainly by Seattle Public Utilities, with part being offset by non-partner contributions (subscriptions). These subscriptions go toward the direct operations and support of the Central Processing Center as well as direct user support, outreach, education, and incidental software/hardware. The Washington Department of Transportation (WSDOT) is a major funding contributor but substantial funds for CORS station maintenance and ongoing operations comes from a wide range of state, federal, and local government agencies.
- Utah Reference Network (http://gis.utah.gov/turngps): This service, named The Utah Reference Network GPS (TURN GPS) provides a high accuracy GPS correction signal for surveyors and GIS mapping. TURN GPS is a network of permanently located GPS receivers (currently about 70 stations), installed throughout the state and border areas outside the state. These stations are incorporated into the real-time network through partnerships between Cities, Counties and State using equipment and facilities, to generate real time high accuracy GPS positioning. TURN GPS is used for a range of precision GPS applications including surveying, engineering, construction, and GIS data collection TURN GPS services are administered by Utah's Automated Geographic Reference Center (AGC) AGC and are available on a subscription basis according to a Legislature approved rate schedule. The Turn GPS Website provides an interactive Web-based interface to identify and download control point information and GPS data.
- Oregon Real-time GPS Network (http://www.theorgn.org/): The Oregon DOT Geometronics Unit is operating and expanding the Oregon Real-time GPS Network (ORGN), a network of permanently installed, continuously operating GPS reference stations. This GPS network consists of GPS Continuously Operating Reference Stations (CORS) that provide real-time kinematic (RTK) correctors to field GPS users over the internet via cellular phone networks. Currently GPS corrector coverage by the ORGN consists of several sub-networks of stations in southern Oregon, central Oregon, NW Oregon (including the Willamette Valley north of Eugene and the Oregon Coast north of Florence), and

northern Oregon along the I-84 corridor. Each sub-network consists of GPS stations spaced at 70 km, more or less. ODOT Geometronics has collaborated with other state and local government agencies, as well as educational institutions and private industry, to develop the ORGN. Our partners have contributed some of the facilities and GPS equipment for the ORGN. In turn, ODOT Geometronics has purchased and is operating the GPS network software that controls the network of CORS stations from central computers. The ODOT Geometronics Unit and ODOT regions also have provided station sites and GPS sensors for the ORGN.

2.3 Summary of Status and Lessons learned

Experiences with similar programs in other states and regions provide several key lessons that can guide the Idaho-Montana GC development and operation:

- The potential user community is broad so data and services provided should be accessible by as large of a user community as possible.
- Development and operation requires substantial funds and it is extremely helpful to have one or a small number of major supporting organizations to provide leadership and major financial support.
- Subscription fees are a reasonable mechanism to support operations although will likely support only a portion of the ongoing budget for operations. Fees should be put in place and kept to a level that matches services being provided and takes into account the market and demand for services. In other words, fees should be high enough to provide reasonable revenue but not so high as to inhibit use of services.
- The GNSS real-time network of base stations should incorporate base stations established, operated, and maintained by multiple public and private organizations and ongoing partnerships with external organizations should be established and sustained.
- GNSS RTN services should provide support for different types of receivers.

2.4 GC Mission, Goals, and Success Factors

The mission statement, high-level goals, and identification of success factors will establish a foundation for this plan and for the work to be carried out to develop and operate the Geopositioning Cooperative (GC). The mission statement, goals, and success factors guiding this project are presented below.

Mission Statement

> *Establish a sustainable geopositioning cooperative that serves the needs of the broad user communities of Idaho and Montana by providing effective access to high-quality geodetic control information, GNSS Infrastructure, and related services.*

Goals

These goals are high-level statements that will help to focus development and ongoing operations. Goals to be addressed in this *Business Plan* include:

1. Establish and maintain a physical facility with the necessary hardware, software, office space, and personnel to support GC services and activities.

2. Develop, deploy, operate and maintain a database and associated Web service for entry of and access to high-quality geodetic control information.

3. Support the establishment of a comprehensive network of stations providing GNSS data for real-time correction of locational data—including connections with stations operated by multiple public sector, private sector, university, and other organizations.

4. Coordinate activities and information sharing among a broad stakeholder community to improve collection of and access to geodetic control information.

5. Define and identify an organizational entity with an effective governance structure to manage and oversee the multi-state geodetic reference center and real-time GNSS services.

6. Identify sources and secure initial funding for development and ongoing financial support for long-term operations.

7. Help provide an environment for improved collaboration, communication, support, and sharing of best practices for geodetic control development and distribution.

8. Establish effective outreach, promotional tools, and activities to encourage and expand the user community and to sustain awareness of and active involvement in GC activities.

3. USER COMMUNITY, BUSINESS NEEDS, AND GOALS

3.1 Summary of Survey

A web-based survey was conducted from early May to mid-June 2011 to gather information to support the preparation of this plan. The full results of this survey are included in Appendix A and may be accessed in spreadsheet form at http://giscenter.isu.edu/research/Techpg/capGC/data/CAP-GCsurvey.xlsx . The survey asked stakeholders for their input on the following topics:

- Current collection and/or use of surveying and geodetic control data
- Purpose/need for surveying and control data
- Limitations encountered in access to or use of control data
- Current sources for surveying and control data
- Current approach/source for GPS correction
- Importance of control and real time GNSS network data
- Geodetic control and survey data accuracy requirements

There were 106 responses to the survey. The breakdown of organizational affiliations of the respondents is as follows:

- Government agency (Federal, state, or local) 54.5%
- Public or private utility company 5.0%
- Survey and/or engineering firm 28.7%
- Agricultural community 1.0%
- Construction/machine control community 1.0%
- Academic/research institution 6.9%
- Other 3.0%

3.2 Description of User Community and Business Needs

Research carried out for this *Business Plan* has identified a wide range of public sector, private, and not-for-profit organizations and individuals with important needs for geodetic control and RTN data. This information serves, and in many cases is essential for business and program requirements of both public and private sector organizations. Organizations and user groups that make use of geodetic control and RTN data include federal and state government agencies, local governments, universities and research organizations, public and private utility companies, regional agencies, private sector service companies, farmers and agricultural service organizations, and not-for-profit organizations. Business needs for geodetic control and real-time GNSS services cover a wide range of needs for these groups including:

- Engineering Planning and Design: Capture of highly accurate horizontal and vertical locations to support preliminary and detailed design for construction or rehabilitation of infrastructure (transportation, utility, buildings, etc.).
- Infrastructure Inventory and Underground Utility Location: Use of real-time or post processed coordinate information to support regular inventory and condition surveys of transportation and utility infrastructure to support infrastructure management and maintenance. This business need also supports required services for locating and marking underground utility assets as a planning step for excavation work. In addition, real-time locational information is essential for the vehicle-based integrated collection

systems (e.g., vans equipped with GPS, video capture, and sensors for street mapping and pavement inventory).

- Land Surveying: Capture of highly accurate horizontal and vertical coordinates to support location and mapping of property ownership boundaries, jurisdictional boundaries, and the legal subdivision of land. Often involves the assignment of accurate positions to physical monuments.
- Parcel Mapping and Property Assessment: Supports the assignment of an acceptable level of map accuracy to parcel maps supporting real property assessment by government agencies and the management of public and private land management (land acquisition, sale, leasing, easement allocation, etc.). Also impacts work on managing surface vs. subsurface rights on public and private land.
- Geologic Mapping and Extractive Industry Operations: Use of real-time or post-processed information support field inventory and mapping of geologic, mineral, petroleum, and gas resources and to support associated operations including permitting, surveying for mining, drilling, and transport operations, and tracking/management of extraction operations. In addition, plate tectonic movement monitoring and precise geothermal activity studies require the use of high-precision GNSS data.
- Digital Map and Aerial Data Registration: Accurate horizontal and vertical coordinate information is essential for precise map registration and for the production of geospatial data from aerial imagery. Coordinate information is applied to non-registered or poorly registered maps (e.g., parcel maps, land use maps) to enhance positional accuracy. In addition, aerial data collection systems (digital aerial cameras, LiDAR) can use real-time GNSS data incorporated with their data collection systems.
- Land Data Collection and Mapping: A wide range of field and mobile data collection activities benefit from and often require real-time, accurate GNSS data. These data collection activities which may include: a) Vehicle-based collection of road and transportation data (e.g., street centerline mapping, sign inventory, pavement inventories), b) Utility facility inventory mapping, c) sensor-based systems providing real-time monitoring data.
- Vehicle Location and Navigation: Real-time coordinate information is a critical requirement to support land and air navigation. This includes commercial, military, and private aircraft navigation and airport management. In addition, this business area encompasses a wide range of vehicle location and routing applications that support such applications as emergency dispatch, automatic vehicle location, freight transport, public works crew dispatch, courier/delivery services, etc.
- Agriculture and Silviculture Operations: Real-time locational information that supports all aspects of field and plot management including treatment, cultivation, and harvest. Horizontal and vertical information along with integration of other geographic data sources supports precision agricultural practices and automated agricultural operations.
- National Spatial Reference System (NSRS) Densification: The NSRS, managed by the National Geodetic Survey (NGS), is a consistent national coordinate system that specifies latitude, longitude, height, scale, gravity, and orientation throughout the Nation, as well as how these values change with time. This includes the maintenance of CORS base stations and monumented control points. Geodetic control activities in Idaho and Montana contribute to the NSRS and are critical since the current trend is for a decrease of direct NGS involvement in CORS station establishment and control point monumentation and maintenance.
- Emergency Management and Response: Coordinate information that supports all phases of emergency management: planning, response, recovery, and mitigation for local, state, federal, and private law enforcement, fire, EMS, emergency management offices, and security organizations. Accurate geodetic control information directly supports mapping information on which emergency planning and response depends (e.g., flood risk mapping, wildfire, infrastructure) and access to real-time GNSS feeds supports emergency management and response in urban and remote areas.

- Terrestrial Structural Data Collection: Use of highly accurate horizontal and vertical coordinate data supports the use of new and developing technology for surface-based 3-D scanning systems that acquire accurate, georeferenced models of buildings and other structures.
- Research: Geographic information science makes increasing use of GNSS data and high precision GNSS data in particular. These data support the development of accurate LiDAR-derived terrain models along with image analysis from high spatial resolution satellite imagery. The latter is key to the early detection of invasive plant species and the accurate delineation of key habitat areas among other areas of research.

Table 3 compares these business needs with the key organizations and user groups.

Table 3: Geopositioning Cooperative User Organizations and Business Needs

	Business Needs													
User Organization Type	Engineering Planning and Design	Infrastructure Inventory/ Underground Utility Location	Land Surveying	Parcel Mapping and Property Assessment	Geologic Mapping and Extractive Industry Operations	Digital Map and Aerial Data Registration	Land Data Collection and Mapping	Vehicle Location and Navigation	Agriculture and Silviculture Operations	NSRS Densification	Emergency Management and Response	Terrestrial Structural Data Collection	Research	**Explanation**
Federal Government Agencies	X	X	X	X	X	X	X			X	X		X	Includes the National Geodetic Survey as the oversight body and manager of the National Spatial Reference System but a wide range of other agencies with mapping, infrastructure, land and resource management, environmental, emergency management needs (e.g., BLM, BOR, USGS, USFS, NRCS, FAA, FHWA, EPA, DHS, DOD, USA-COE and others).
State Government Agencies	X	X	X	X	X	X	X	X	X		X			As is the case in the Federal government sector, multiple Idaho and Montana state agencies with infrastructure and land management responsibilities depend upon geodetic control data and often RTN services. In addition to the transportation agencies in each state (Idaho Transportation Department, Montana DOT) other agencies use geodetic control information. In Idaho, this includes the State Tax Commission, Idaho Geologic Survey, Idaho State Police, Idaho National Guard, Idaho Bureau of Homeland Security, and the Idaho Departments of Water Resources, Lands, Environmental Quality, Health and Welfare. In Montana, state agencies that gather and/or use geodetic information include the Departments of Environmental Quality; Commerce; Fish, Wildlife & Parks; Natural Resources and Conservation; Military Affairs; and the state Natural Heritage Program.
Local Government Agencies and Tribal Governments	X	X	X	X		X	X	X			X			City and County government agencies and Tribal governments have fundamental business needs for high-quality geodetic control information even if these needs are not always being met at this time. These include: a) parcel mapping, real property appraisal carried out by County Assessors, b) road and public utility infrastructure development and maintenance, c) emergency management and public safety offices.
Regional Agencies		X		X		X	X							Includes public sector organizations with specific planning and/or services responsibility for a specific geographic area which may be a sub-county or multi-county area. In Idaho and Montana, some examples include school districts, economic development associations, metropolitan planning organizations, and special public services.

	Business Needs													
User Organization Type	Engineering Planning and Design	Infrastructure Inventory/ Underground Utility Location	Land Surveying	Parcel Mapping and Property Assessment	Geologic Mapping and Extractive Industry Operations	Digital Map and Aerial Data Registration	Land Data Collection and Mapping	Vehicle Location and Navigation	Agriculture and Silviculture Operations	NSRS Densification	Emergency Management and Response	Terrestrial Structural Data Collection	Research	**Explanation**
Private Sector-Land Related Activities and Services	X	X	X		X	X	X		X			X		This includes any private company with a business focus on land management and/or land development services. Included in this group are such firms: a) firms providing surveying or engineering services supporting property surveys, infrastructure design, and support for construction, b) mining/mineral extraction companies, c) residential and commercial land development, d) oil and gas extraction and transport, e)recreational development and service companies, f) forest/timber companies, and others.
Private Sector-Commercial and Industrial		X		X				X	X			X		Includes any firms that make use of mapping, geodetic control, or RTN services to support their retail, commercial, or industrial business operations.
Farmers and Agricultural Services				X		X		X	X					Individual farmers, companies involved in agricultural or production and forestry operations, and companies that provide services (including RTK data) to the agricultural and silvicultural community.
Utility Organizations	X	X	X	X		X	X							Private utility companies, cooperatives, and public utility organizations providing water, wastewater, electric, gas, and telecommunications services and which rely on mapping and geodetic coordinate information for infrastructure design, construction, monitoring, and maintenance.
Universities/ Research Organizations	X	X			X	X				X		X	X	Includes both state supported and private colleges and universities as well as non-university private or government supported research institutions.
Not-for-Profit Organizations			X		X		X	X	X			X	X	Includes any non-governmental or non-profit organizations, companies, or associations that may make use of geodetic control information or GNSS services now or in the future. Some possibilities include land conservation or environmental groups (e.g., Nature Conservancy), recreational or outdoor sport organizations (e.g., Ducks Unlimited), various service organizations, non-profit research organizations, etc.

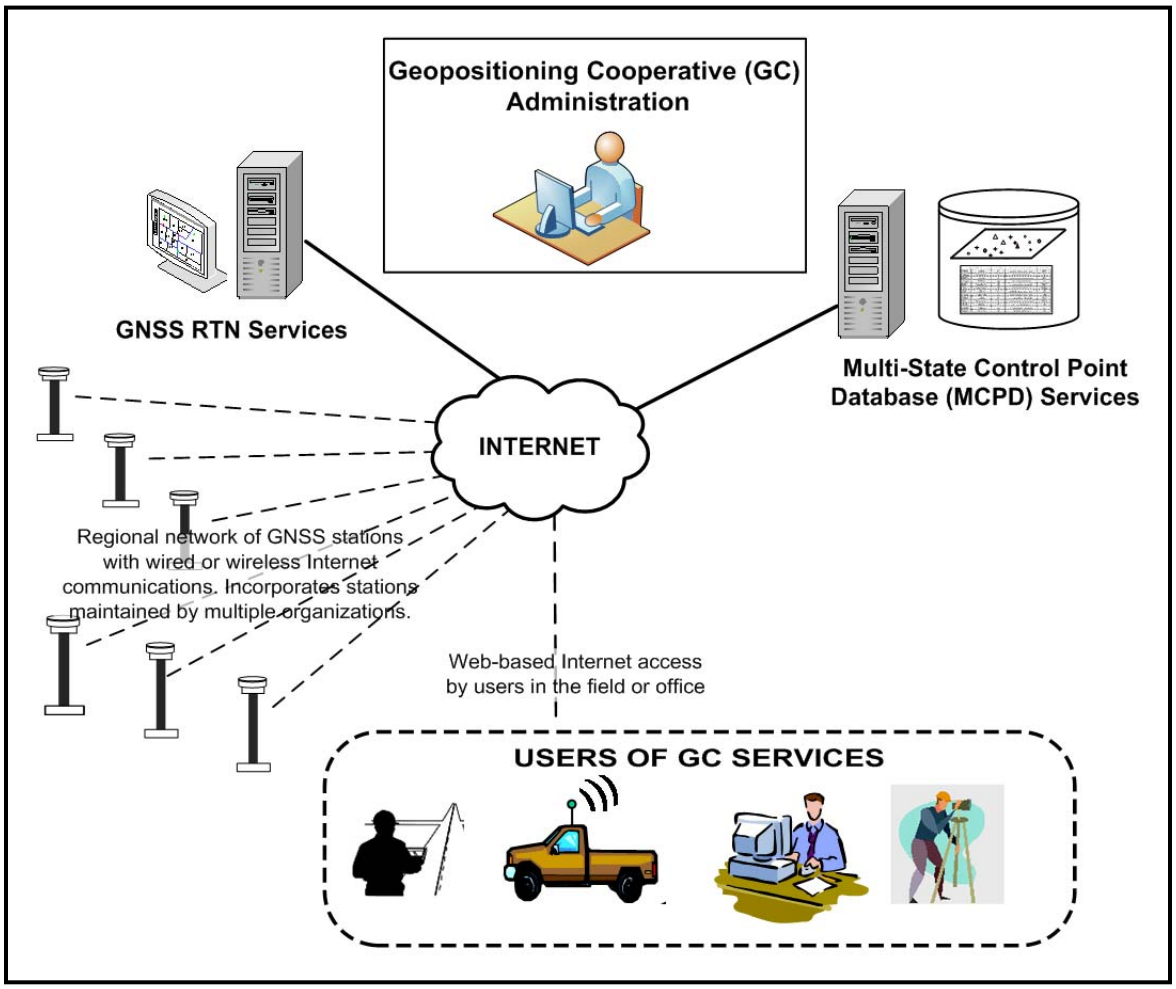
4. GEOPOSITIONING COOPERATIVE AND GNSS BENEFITS AND JUSTIFICATION

4.1 Long-term Picture of Geopositioning Cooperative

The term "Geopositioning Cooperative" encompasses all organizational elements, technical infrastructure, and services for management of geodetic control information and operation of the real-time GNSS network. As conceptually depicted in Figure 2, this includes:

- Governance structure and management to oversee and direct operations
- Staff to support services, system operations and maintenance
- Multi-state Control Point Database (MCPD) and services for entry of and access to control data
- Computer systems and network to the MCPD and RTN services
- Physical facilities (office space and amenities) to support operations

Figure 2: Geopositioning Cooperative Components



4.2 Benefits and Business Justification

The need for geodetic control and real-time GNSS information is confirmed as evidenced by the following studies and statistics:

- American Surveyor Magazine, "Real-time GNSS Network in New Mexico", Vol. 7, No. 9, www.amerisurv.com/PDF/TheAmericanSurveyor_Wilkie-ARTGN_Vol7No9.pdf .
- Allen Consulting Group, Economic Benefits of High-Resolution Positioning Services, final report, 2008, www.crcsi.com.au.
- National Academy of Sciences, *The Global Positioning System-the role of Atomic Clocks*, special publication, Beyond Discovery, 1997, www.beyonddiscovery.org/includes/DBFile.asp?ID=84.
- National Academy of Sciences Press, *Precise Geodetic Infrastructure: National Requirements for a Shared Resource*, special publication by the National Research Council Committee on the National Requirements for Precision Geodetic Infrastructure and the Committee on Seismology and Geodynamics, 2010.
- National Geodetic Survey, *Guidelines for Real Time GNSS Networks*, version 2.0, March 2011.
- V1 Magazine, "Is high Accuracy GNSS Now a Basic Need?", February 18, 2011, Vector 1 Media, http://www.vector1media.com/dialog/perspectives/18555-is-high-accuracy-gnss-now-a-basic-need.html.
- Professional Surveyor Magazine, several articles on GNSS networks, June 2011 and June 2009.

The justification for the Geopositioning Cooperative and the services described in Section 5 of this plan is based on three premises:

1. There exists a critical and ongoing need for high-quality geodetic control information by a wide range of organizations and individuals.

2. There has been no single, easy to use service for accessing comprehensive geodetic control information in the Idaho-Montana region. The current necessity for users of geodetic control information to consult multiple sources or acquire their own control information is expensive, duplicative, and impractical.

3. There is a rapidly growing need for a robust, real-time GNSS network to support field-based operations and location-based services, which demand highly accurate, real-time coordinate information.

Each of these premises is explored in more detail below as a means to establish a strong business case for the GC and the profound benefits that will result.

4.2.1 Critical and Ongoing Need for Geodetic Control Information

The results of the survey of organizations in Idaho and Montana summarized in Section 3 and Appendix A, and the description of organizations and business needs in section 3.2 present strong evidence that high-quality geodetic control information is vital for a large number of public, private, academic, and non-profit organizations.

The business needs for high quality, readily available geodetic control information are summarized as follows:

- Geodetic control information is the basis for all mapping activities. As a foundation “layer” of data, geodetic control points and reference information in sufficient quantity and quality are the necessary starting point for any mapping or geographic data collection project.
- Federal programs operating at national, state, and regional levels depend on geodetic control information to manage land and deliver vital services to organizations and individuals. The list is long but a few examples suffice to illustrate the importance of efficient, reliable access to geodetic control data:

- ✓ National Geodetic Survey has as its primary mission, the maintenance of the National Spatial Reference System (NSRS). The NGS manages a network of CORS stations and works with other Federal and state agencies to provide access to data from these stations. The NGS operates the On-line Positioning User Service (OPUS). As noted previously, NGS's direct support for establishing and operating stations is decreasing which will place more responsibility on state and local governments and private companies.
- ✓ The Federal Aviation Administration (FAA) has a Global Navigation Satellite System (GNSS) Program Office that provides satellite (GPS) based positioning, navigation, and timing (PNT) services in the United States to enable flight operation management for all phases of flight from en route, terminal, approach, and surface navigation. PNT services are an essential enabler required to overcome the deficiencies in today's air traffic infrastructure and support implementation of the Next Generation Air Transportation (NEXTGEN) system for the United States' National Airspace System (NAS). The FAA's plan to provide PNT services requires implementation of two GPS augmentation systems, the Wide Area Augmentation System (WAAS) and the Ground Based Augmentation System (GBAS).
- ✓ The Geographic Coordinate Data Base (GCDB) program, managed by the USDI Bureau of Land Management (BLM), uses geodetic control information to establish coordinate reference to the Public Land Survey System (PLSS) grid. The GCDB supports mapping and land management needs of many government agencies and private companies.
- ✓ Federally funded infrastructure planning, design, and development work depends on accurate geodetic control information. Work carried out or funded by the Federal Highway Administration, U.S. Army Corps of Engineers, Bureau of Land Management, National Park Service, and other Federal agencies.
- ✓ The U.S. Forest Service manages 21 National Forests in Idaho and Montana covering an area of 45.5 million acres. Geodetic control information supports on-going activities for forest management, building and maintenance of roads, fire threat monitoring, and emergency response.
- ✓ The U.S. Bureau of Land Management manages a total of 20 million acres in Idaho and Montana and requires geodetic control information to support renewable energy, fire, grazing permits, recreation, endangered species projects to name just a few of BLM's responsibilities.
- ✓ The U.S. Geological Survey has responsibility for a range of mapping (maintenance of the National Map), field-based collection and monitoring activities (e.g., water flow/quality, seismic monitoring) and a number of earth science programs for which geodetic control information is essential.
- ✓ Current DHS-FEMA programs for Flood Map Modernization (Map Mod) and Risk Mapping, Assessment, and Planning (Risk MAP) require geodetic control information for georegistration of existing maps and for new hydrologic studies supporting flood hazard mapping.

- Infrastructure design, development, and maintenance work carried out by local and state governments and utility organizations depends on accurate geodetic information. Work carried out by State transportation agencies (ITD and MDT), city and county public works and transportation departments, and public or private utilities (water, wastewater, gas, electric, telecommunications) in the areas of preliminary engineering planning and cost estimation, detailed engineering design, construction inspection and management, and infrastructure maintenance cannot be carried out without geodetic control information. It is useful to note that the 2009 "Report Card for America's Infrastructure" prepared by the American Society of Civil Engineers (see www.infrastructurereportcard.org) which rates the condition of transportation, utility, and other infrastructure assets points to major deficiencies in Montana and Idaho in dams and in road, bridge, water and wastewater infrastructure. This underscores the critical needs for major infrastructure maintenance and rehabilitation which will require geodetic control information and GNSS services.

- There exist a number of state legal and regulatory mandates that specifically require the use of control information tying boundaries and assets to absolute locations. Idaho and Montana statutes (e.g., Idaho Code 54-1227) require the precise positioning and documentation of legally defined boundaries by qualified, licensed individuals. These laws are of huge importance because they are the basis for legal conveyances, transactions, and programs with regulatory or judicial mandates. Among these are:
    - ✓ Land ownership/land rights transfer
    - ✓ Pipeline safety
    - ✓ Underground utility locate services
    - ✓ Flood insurance
    - ✓ Air, solid waste, and water environmental protection programs and clean-up initiatives
    - ✓ Endangered species protection
- The vital need for accurate control data to support the mapping of legal boundaries, defining areas of jurisdiction, ownership, and land rights cannot be understated as evidenced by the following:
    - ✓ Billions of dollars worth of public and private land transactions (sales, acquisition, easement allocation, leasing) occur on an annual basis in Idaho and Montana. The value of these transactions relates directly to the establishment of accurate legal boundaries and the location of infrastructure.
    - ✓ Proper management of resources and subsurface land rights requires accurate geodetic control information and legal boundary data. Proper oversight of water rights, mineral rights, and forest harvesting programs, which involve billions of dollars, cannot be effectively executed without legal boundary and control information.
    - ✓ Local governments and special service districts depend directly on revenue from real property taxes. A comprehensive and equitable real property assessment program, compliant with appropriate laws and regulations, depends on accurate legal boundary information
    - ✓ The Geographic Coordinate Data Base (GCDB) program managed by the Federal Bureau of Land Management is a collection of geographic information representing the Public Land Survey System on public and private land. The GCDB grid is computed from BLM survey records, local survey records, and geodetic control information. This grid is the cadastral reference or base map that not only federal mappers, but also the vast majority of counties use for their tax parcel mapping. Due to budgetary limitations, the BLM in Idaho and Montana were not able to use extensive local survey information in compiling the GCDB. As a result, the reliability and spatial accuracy of the PLSS corner coordinates in the GCDB varies widely. If more accurate geodetic control information were easily accessible, the GCDB could be greatly improved and become an invaluable resource for all parcel mappers.
    - ✓ For those county and city governments that have the means to maintain their own PLSS information, more accurate control data, directly supports the effective mapping and management of real property in private ownership.
- The importance and value of agriculture and silviculture in Idaho and Montana underscores the need for accurate geodetic control information for field/plot management and to support the increasing use of precision agricultural practices.
- State and local emergency management and public safety agencies (law enforcement, fire, rescue, emergency medical) depend on location information and maps developed on a foundation of accurate geodetic control. The preparation of emergency plans and risk assessment requires accurate geodetic information. Effective emergency response is supported by geodetic data to accurately pinpoint incident locations—particularly from cell phone calls for which E911 address location data is not available.

4.2.2 Need for a Single, Convenient Service for Submittal and Access of Geodetic Data

With the exception of the recently implemented Montana Control Point Database, there has been no reliable, central source for comprehensive control point data. In fact, this Montana database was established to fulfill this unmet need and address a range of problems and obstacles to managing and accessing geodetic control information—a few of which are explained below:

- The National Geodetic Survey's Web site (www.ngs.noaa.gov) has functioned for many years as a source for geodetic control information and a service to provide post-processing for GPS data collection (the NGS OPUS program). But the NGS has not been a comprehensive source of control point data and indications (driven by Federal budget and organizational decisions) are that the NGS role will decrease in the future.
- The state transportation agencies in Idaho and Montana (ITD and MDT) gather and use a large amount of geodetic control information (in-house staff and contractors) because it serves a vital business need for transportation infrastructure development and maintenance. The state transportation agencies could benefit greatly from a central source and easy access to high-quality control data from other agencies. Likewise, other organizations would realize a significant time and cost savings if state transportation agency control data were easily available.
- The case of state transportation departments explained above is repeated many times at the local and regional level by City and county public works departments and utility organizations which collect and use geodetic control data for infrastructure projects. Savings in research time and direct costs are substantial if a central source of data were available.
- Some local governments in Idaho and Montana are pursuing projects to tie existing legal boundaries and monuments (from the Public Land Survey System) to accurate geodetic locations and thereby provide a more effective foundation for mapping and land management. These projects are expensive but costs can be contained if geodetic control information could be made more readily available.
- The private surveying community must research geodetic control information for every new project or job they start. This usually involves a trip to numerous county offices to search their files and make copies of the information they need. A centralized repository would obviously make their work more efficient, but beyond that, for those surveyors that contribute information to the MCPD, their information is stored in a secure, off-site, standardized database.

A central site and service for submittal and access to reliable geodetic control information was identified in the state of Idaho's strategic and business plans for statewide spatial data infrastructure (2008, 2009). This has not been acted upon however because of resource limitations. The interest remains and this business planning process is seen as a vehicle to respond to this need.

The Montana Control Point Database in its current, early form has already provided evidence of the popularity and benefits for a service that allows for the submittal, query, and access to geodetic control information for Montana users.

4.2.3 Increasing Need and Benefits for Real-Time Network Services

The use of GNSS data to support a range of location-based activities has advanced rapidly over the past 20 years to the point today that GNSS data is an expected, and to a large extent transparent, component of routine location-based applications and services. Throughout the 1990s, real-time positioning using the existing Navstar (GPS) constellation of satellites was crude—because of the limitation of existing receiver technology and the imposition of selective availability (SA) by the Defense Department which intentionally degraded accuracy. Accurate positioning with GPS (better than about 3-4 meters horizontal) required post-processing with data from one or more base stations. Regular advances in receiver technology and the discontinuation of SA in 2000 provided a basis for highly accurate real-time positioning. The introduction of additional satellite

constellations (the Russian GLONASS and European Union Galileo) and advances in receiver technologies (H-star and Delta phase processing) to accept and process GLONASS and Galileo signals, provided further opportunities for increased positioning accuracy.

As described in 3.2, real-time positioning at resource-grade accuracy (~ 1-meter range horizontal) as well as survey-grade accuracy (centimeter range) supports a large range of business needs (e.g., land surveying, infrastructure location and inventory, vehicle navigation, emergency response, scientific research, precision agriculture, geotagging). Expansion of the network of accurate base stations, as called for by this plan, is justified by the tangible and intangible benefits of real-time positioning. Many applications (e.g., precise navigation, precision agriculture) cannot evolve without a robust RTN service. Other uses of an RTN network alleviate the need for setting up and dismantling a project-related total base station—and associated time and costs for post-processing (e.g., OPUS).

As documented by the USGS (see http://water.usgs.gov/osw/gps/real-time_network.html#benefits) and other sources, there are major benefits for a real-time GNSS network with Web-based access to real-time correction services, relative to other real-time correction approaches—such as local real-time kinematic (RTK) correction. A major advantage is that it provides users, which rely on one or a small number of locally operated base stations. The RTN can access data from a wide network of continuously operated stations without an ongoing need or cost for local base station set-up and with considerably fewer problems with weather, visibility, or equipment malfunction that can accompany RTK operations. In addition, a GNSS RTN with Web accessible services provides great flexibility and can support real-time correction for a wide range of field-based devices, receiver specifications, and correction software.

Some specific examples and cases that illustrate the advantages and benefits of using RTN services:

- A recently established RTN in the northern Appalachian region of Pennsylvania is being actively used to support exploration and development of gas extraction from the Marcellus shale formation. This privately maintained RTN provides subscription services to surveyors and resources development companies (over 200 active users) to support work in initial property surveys, planning, permitting, and design for construction of exploration and production drilling (see *Professional Surveyor Magazine*, "Second Boom", June, 2011, p.11 to 14).
- The Minnesota Department of Transportation (MNDOT) --the first state-owned network in the US--implemented a real-time CORS-based network in 2000-2001 to support maintenance activities and field-based data collection activities in the Twin Cities area. The RTN was implemented in response to limitations and costs associated with the use of RTK technology. The benefits derived from this initial implementation, which include streamlined access to real-time correction services and lower costs, are driving expansion to other regions of the state. Currently, the RTN services are used primarily by the MNDOT but are made available to other users.
- The FAA, through its GNSS Program Office provides satellite (GPS) based positioning, to support all phases of flight operations existing and planned use of real-time GNSS services, the Wide Area Augmentation System (WAAS) and the Ground Based Augmentation System (GBAS) depend on a robust RTN. Direct benefits include reduced time and distance for runway, greater runway capacity to terminal, reduced workload for air traffic controls, critical safety benefits for directing airlane traffic, and reduced costs for older ground-based navigation systems.

5. GEOPOSITIONING COOPERATIVE AND GNSS NETWORK SERVICES, TECHNICAL ARCHITECTURE ORGANIZATIONAL STRUCTURE, AND MANAGEMENT

5.1 Services to be Provided

This section describes the services that are planned for the Geopositioning Cooperative (GC). Table 4 identifies these services and presents the following information:

- Description of potential services
- Priority
- Resource Requirements: general description of staff and other tangible resources required to establish and provide the service

The decisions on which service to implement and when to implement will be based on user needs and availability of resources. The priority level assigned to each service reflects its importance and gives a general basis for relative timing for implementation.

Table 4: Potential Services to be provided by the Geopositioning Cooperative

Potential Program or Service	Description	Priority[1]
Multi-State Control Point Database (MCPD) Operations	MCPD operations encompass the following components: a) the control point database with metadata, b) Web-based applications for querying and accessing control point data, c) Web-based tools for entry of new control point data and quality assurance checks	VH
RTN Set-up and Operations	RTN services involve the establishment and configuration of new base stations, monitoring and maintaining RTN station operations, and providing access to real-time network solutions to users. This service encompasses maintenance of the network, Web services, Web-based access to RTN station data to support real-time correction, and support to users. The GC may have direct responsibility for some stations but a primary task will be to coordinate with other organizations to integrate stations they maintain into a cohesive RTN and to progressively identify and bring in new partners and additional stations.	H
General assistance to the user community	Geopositioning Cooperative staff will be available to respond to questions and provide basic advisory support and consultation to users of geodetic information. This may include ad hoc answers to questions (via phone, email, in person) and the creation of a query tool and knowledge base to provide Web-based response to questions. Assistance may relate specifically to the use of the MCPD and RTN network or assistance in the use of data for specific projects or applications. Center staff will assist data providers with project and point submissions using the standardized spreadsheet or potential special circumstances with large data holdings in non-standardized format.	H
Liaison and Support to the NGS	The National Geodetic Survey is the Federal agency charged with maintenance of the National Spatial Reference System (NSRS). This service implies that the Geopositioning Cooperative will provide support and participate in NGS activities relating to the NSRS. Note: the NGS role and level of direct support to states is currently evolving, with the likelihood that direct NGS liaison functions will decrease in the future. Therefore, the role and services of the GC will also evolve taking into account NSRS development and maintenance needs and available resources.	M
State GIS Program Support	Idaho and Montana each have statewide GIS programs that coordinate GIS activities for a wide range of stakeholders and which support a GIS data clearinghouse and related services. Idaho's statewide GIS program is directed by the Idaho Geospatial Council and in Montana, the state GIS program is part of the Montana State Library with coordination support by the Montana Land Information Advisory Council (MLIAC). This service calls for the Geopositioning Cooperative to be an important component of both State GIS programs and to be involved in and support all appropriate GIS database and application initiatives.	M
Special Projects	The Geopositioning Cooperative can be positioned (from an organizational and resourcing standpoint) to participate in special projects that involve the acquisition or use of geodetic control information—in a lead or support capacity. There are a broad range of project types and sponsoring or partner organizations. Such projects may be funded by government or private organizations (including through grant programs). Some possible project types include: a) Height Modernization, b) Guidance and standards for establishing base stations and incorporation into the RTN, c) Advisory services for setting up applications for use of geodetic control data and GNSS RTN service.	L
Involvement in Academic and Research Activities	Accurate real-time positioning is becoming increasingly important to support research at Idaho and Montana universities.	M

[1]Priority scores use a subjective sliding scale indicating level of need or importance from "L" (Low) implying little or no need or importance, "M" (Moderate), H (High), to VH (Very High) indicating that the service is critical and an essential part of the GC operations.

5.2 Technical Architecture and Specifications

A properly designed and deployed GC is fundamental to its long-term success and sustainability. The following section describes the architecture and specifications for the MCPD with associated web service as well as the Idaho-Montana RTN.

5.2.1 Multi-state Control Point Database Service

The Multi-State Control Point Database (MCPD) contains information about the Public Land Survey System (PLSS) and other control points submitted by professional land surveyors. It is a mechanism to collect and deliver surveyed control information as a standardized, federated, and openly accessible resource. Primarily designed to help surveyors with professional research needs, the data can be downloaded and used for other purposes such as PLSS or parcel readjustment. The MCPD provides a Web-based search and display tool for finding applicable control data and accessing it. Figure 3 is an example of the Web application interface.

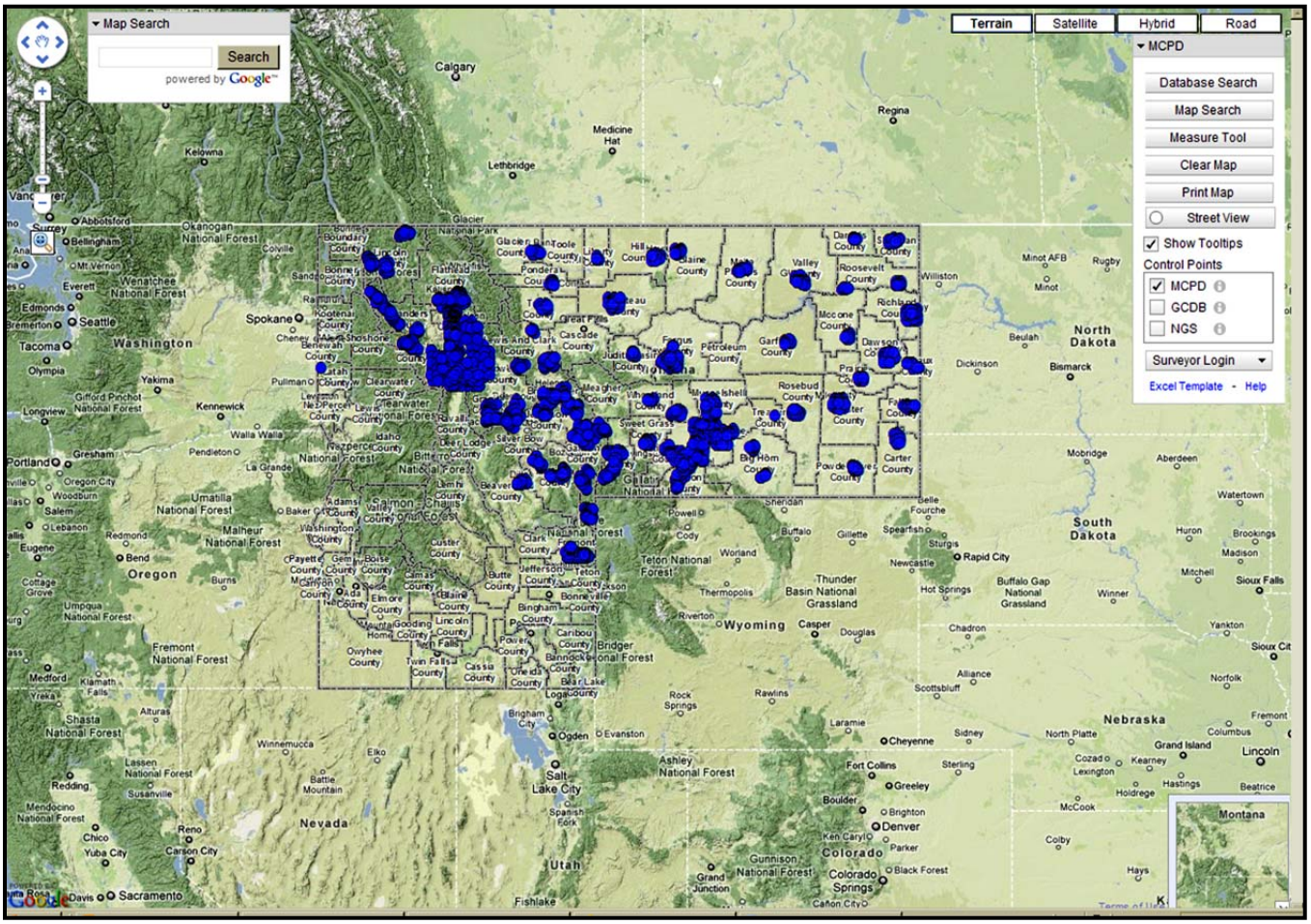
The infrastructure requirements for the MCPD include a server or a portion of a server with backup and failover contingencies in place. The Montana Control Point Database is currently housed at the Montana State Library. The MCPD will replace the Montana Control Point Database and will initially operate from the Montana State Library as well. It would be possible, in the future, for the MCPD server and software to be physically moved from its current location in Montana to another location (e.g., the ISU GIS Training and Research Center) or configure MCPD services through contracted hosted services (e.g., cloud storage and compute resources provided by a third party). Wherever the application resides, funding for both server and software upgrades and ongoing IT support will be necessary.

The software needs supporting the MCPD include ArcGIS Server, ArcSDE and relational database software. These software products and especially the relational database software, will require the services of a database administrator. The current, custom MCPD application will be reviewed periodically and enhancement or application changes will be made as necessary. Future funding will need to be secured for the anticipated enhancements and changes to the application.

In addition to standard IT administration of the server and software, a licensed public land surveyor (PLS) will be required for quality assurance reviews of data submitted for inclusion in the MCPD. This position will not only be responsible for perusing the data, but also providing technical assistance and feedback to users and data providers. Initially, it is estimated that a 0 .25 FTE would be necessary for this data steward position.

As both the Montana State Library and the Idaho State University's GIS Training and Research Center currently have and maintain the above mentioned software, those startup costs would be minimal for the MCPD. The specialized personnel, however, are another matter as the data administrator position is critical to the success of the MCPD. Although volunteers may be able to provide this service initially, this is not sustainable and the position would need to filled at an estimated startup cost of about $20,000.

Figure 3: MCPD Web-based Search and Display Interface



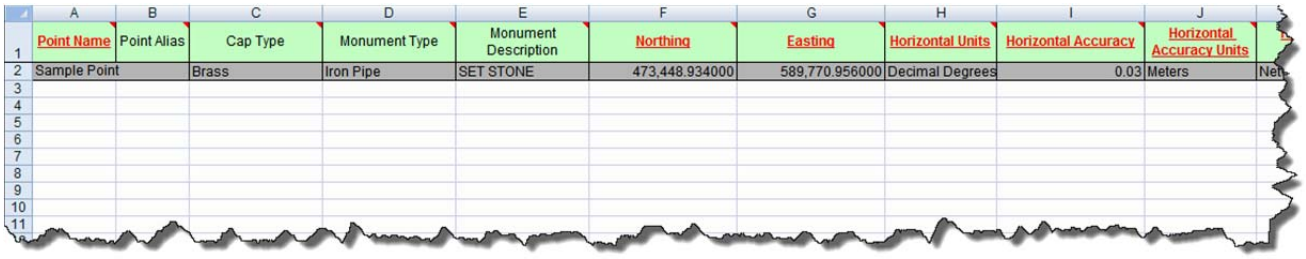
The main search and analysis tools accessible from the Website include:

- **Database Search tool** allows you to export MCPD or GCDB control point data through ASCII (text) or KML file through an attribute query interface.
- **Map Search tool** allows you to create an ASCII or KML file based on a subset of MCPD or GCDB control points by drawing a polygon or creating a buffer around a group of MCPD or GCDB control points.
- **Measure tool** allows you to measure approximate distances on a map by drawing a line. Total and individual segment distances are displayed.
- The application provides access to the NGS point information, not through a direct download process, but by providing a direct link to NGS data sheets.
- The application will allow the user to download GCDB points, but these points are not maintained in the MCPD and therefore should be used for reference only. The most up-to-date GCDB information has to be obtained from BLM.

The application provides comprehensive information about the control points such as datum, horizontal method, accuracy, etc. It also provides the name, license number, and contact information about the surveyor who collected the point. The information can be queried and displayed individually or downloaded in bulk to ASCII or KML.

The application also provides access to a spreadsheet that surveyors use to submit their data to the data base (see Figure 4). The spreadsheet provides a comprehensive standardized way to store survey information.

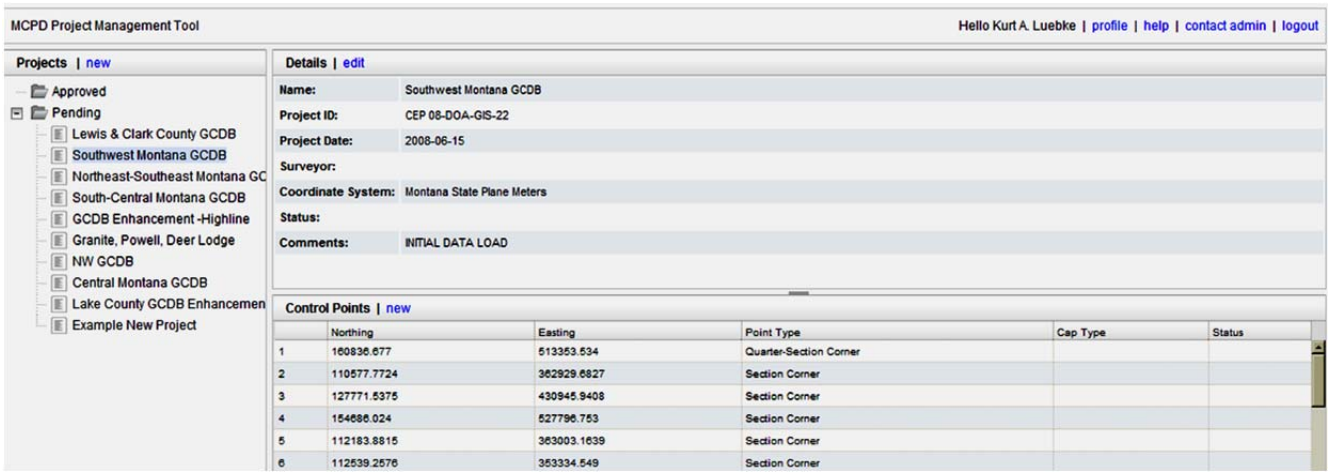
Figure 4: MCPD Data Submittal Spreadsheet Format



	A	B	C	D	E	F	G	H	I	J
1	Point Name	Point Alias	Cap Type	Monument Type	Monument Description	Northing	Easting	Horizontal Units	Horizontal Accuracy	Horizontal Accuracy Units
2	Sample Point		Brass	Iron Pipe	SET STONE	473,448.934000	589,770.956000	Decimal Degrees	0.03	Meters

Once their data are included in the database, the application provides the surveyor with the opportunity to update or correct their information before it is posted to the public facing web map (see Figure 5).

Figure 5: MCPD Data Submittal Edit Form

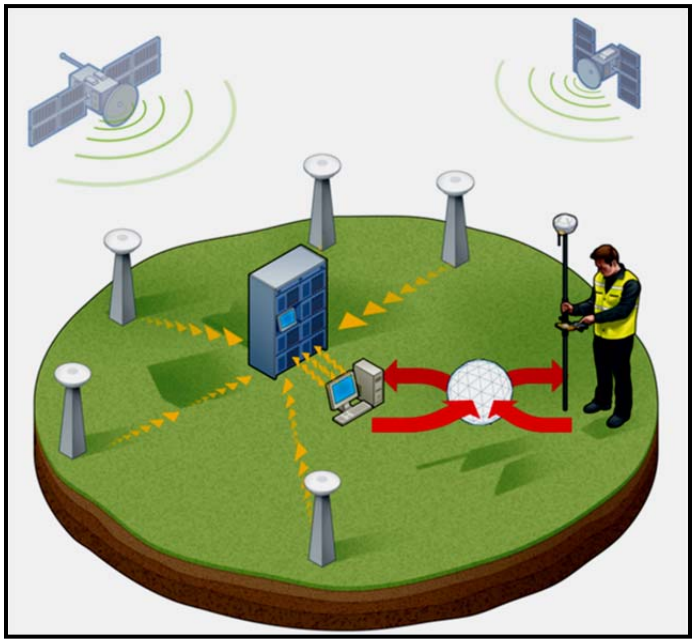


5.2.2 GNSS Real-Time Network

The proposed GNSS Real-Time Network RTN consists of a substantial number of properly placed and configured base stations eventually covering the entire Idaho-Montana Region. This network of GNSS base stations will provide correction data to users via Web services. As shown in Figure 6, The GNSS RTN, consists of permanent base stations that are in communication with a Web server (via wireless or wired communications) data from these stations is then accessed, via the Web by users in the field to perform real-time correction of their locational data collection.

Figure 6: Concept of GNSS Real-time Network

(Courtesy of Wisconsin Department of Transportation)



The installation of real time positioning networks (RTN) is rapidly growing nationally and throughout the world. These networks are eliminating the need for traditional total base stations and thus changing the way survey data is collected. Using a wireless data link from the user in the field to the network server, precise positions can be acquired by the receiver with low latency, high accuracy (+/- 2 cm), high repeatability, and high reliability (24-hours per day, 365 days per year). The GNSS server makes correction data available in a variety of formats (e.g., RTCM, CMR, CMR+) suitable to a broad stakeholder community as well as archives data for post-processing as needed. GNSS base stations would be capable of accepting and processing data from GPS satellites and other GNSS systems (e.g., GLONASS, Galileo).

Comprehensive development of the Idaho-Montana GNSS RTN will require 244 high accuracy base stations. Based upon an average cost of $20K for each base station an investment of nearly $5 million, over a multi-year development period, will be needed for these stations. Numerous (54) high-quality base stations already exist however, significantly reducing the cost of implementation. This existing investment will serve as a foundation for future build out of the RTN. Each new base station should be constructed following CORS site specifications to ensure the long-term viability of the base station. Existing base stations will need to be visited and potentially retrofitted to meet these specifications. In addition, each base station must have connectivity to high-speed internet to ensure low latency of real-time data transmissions.

Currently, a server constellation exists at Idaho State University's GIS Training and Research Center which has been configured to support the RTN server application. Indeed, one of these servers is currently participating in an RTN trial period using Trimble's VRS^{3}Net software. The full build-out of the RTN will require the purchase and configuration of a second server to ensure failover reliability of the network. The capital investment required for RTN software (using commercial off-the-shelf solutions) and a second server is approximately $200K (most of which covers software licensing and support) with $15K annual relicensing costs. In addition, there are personnel requirements associated with the RTN including a part-time RTN System Administrator (initially a 0.25 FTE position growing along with the network build-out) and ultimately a second RTN Operator who will be funded at 0.50 FTE and on duty throughout the weekends and holidays. Personnel costs are estimated at $52K annually.

5.3 Organizational Structure and Governance

5.3.1 Organizational Structure Issues and Requirements

GC operations require, at least in the long-term, a defined organizational entity and formal oversight that positions the GC to provide services and to support necessary business relationships with other organizations. While this *Business Plan* recommends initial GC establishment with an informal structure, long-term GC success calls for a more formal organizational structure and management that addresses the following requirements:

- The GC organizational structure should be as administratively and legally simple and streamlined as possible.
- The organizational entity responsible for GC management and operations should not have any major operational or jurisdictional limitations for services covering the two-state region.
- The GC organization should allow service and support to a wide range of public sector, academic, and private organizations and it should not be so closely tied to the mission of a specific agency, which may inhibit the provision of services to the broad stakeholder community.
- There should be specific administrative freedom and legal status allowing use of multiple funding sources and resourcing options and to share resources with other organizations.
- The GC organization should have a legal status with the ability to handle monetary transactions and to enter into formal contracts and agreements.
- The organization type should allow an advisory body to oversee and provide direction to the GC.
- The organization may leverage existing resources within the states to accomplish all or portions of the goals listed in 2.4 above.

During this planning process, a number of options for the "organizational type" were considered including:

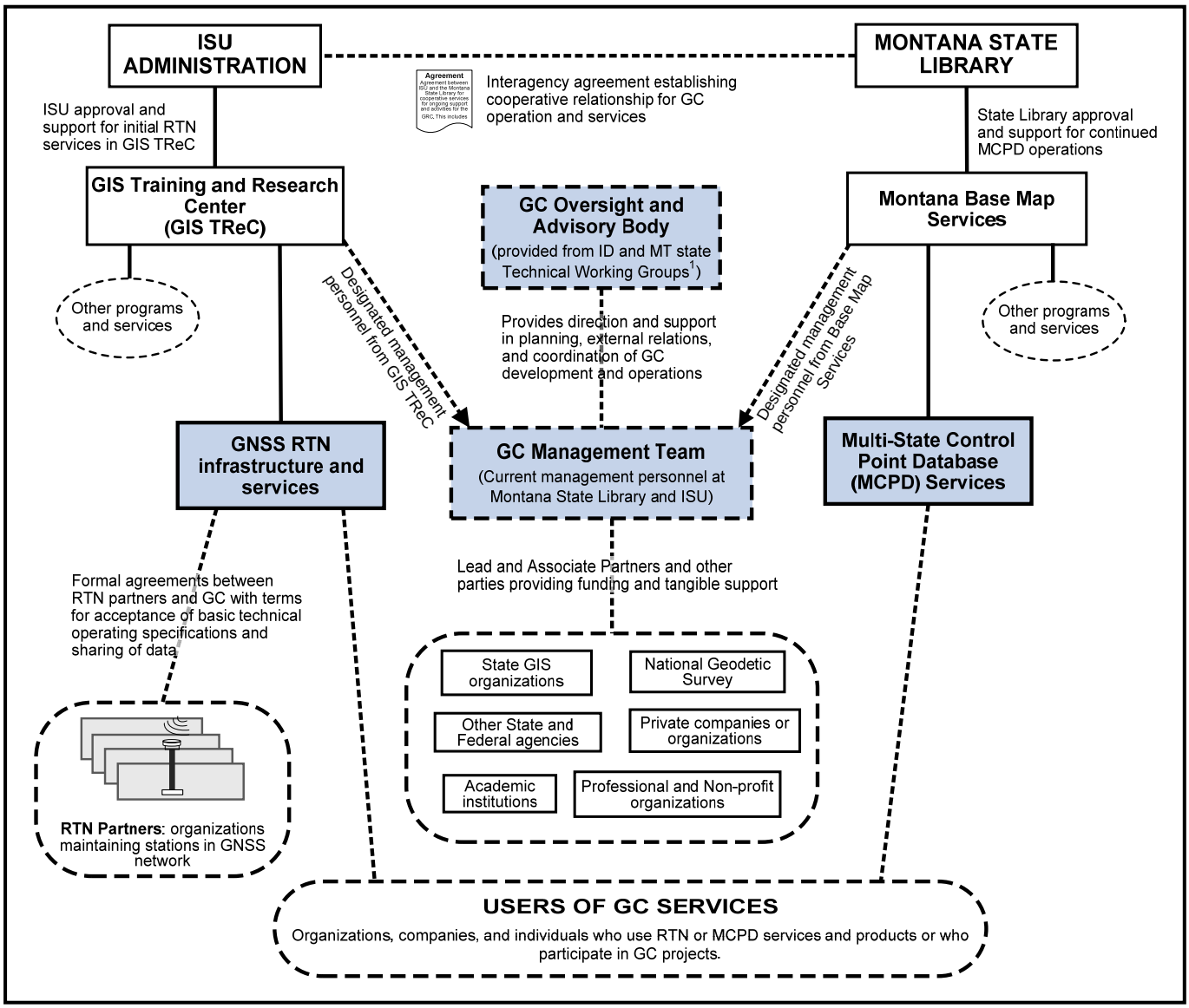
- GC management and operations by a State agency (in Idaho or Montana).
- Creation of a new, non-profit organization (under one of several IRS Code 501(3) provisions).
- GC operations placed inside an existing University program which already has a mandate and mission that is consistent with GC goals and services.
- A multi-organization consortia established through formal agreements between parties—with one of the parties or a newly created office assuming a leadership and management role.

GC organizational development should begin with an informal structure being put in place and operating during initial phases with a move to a more formal structure that creates a GC management office with assigned staff. These organizational recommendations are described in subsections 5.3.2 and 5.3.3.

5.3.2 Initial Information GC Organizational Structure

The rationale for using an informal organizational approach for the GC acknowledges the complexity of a more formal structure and that it will take time to secure necessary resources and to get organizational commitments for a formal GC structure with a defined management office and staff. The initial informal structure is composed of existing organizations involved in GNSS RTN development and MCPD services—specifically the ISU GIS Training and Research Center (GIS TReC) and the GIS Base Map Service Center in the Montana State Library. Figure 7 depicts this informal GC organizational structure.

Figure 7: Initial GC Organizational Structure



[1]Idaho and Montana State Geodetic Control Working Groups

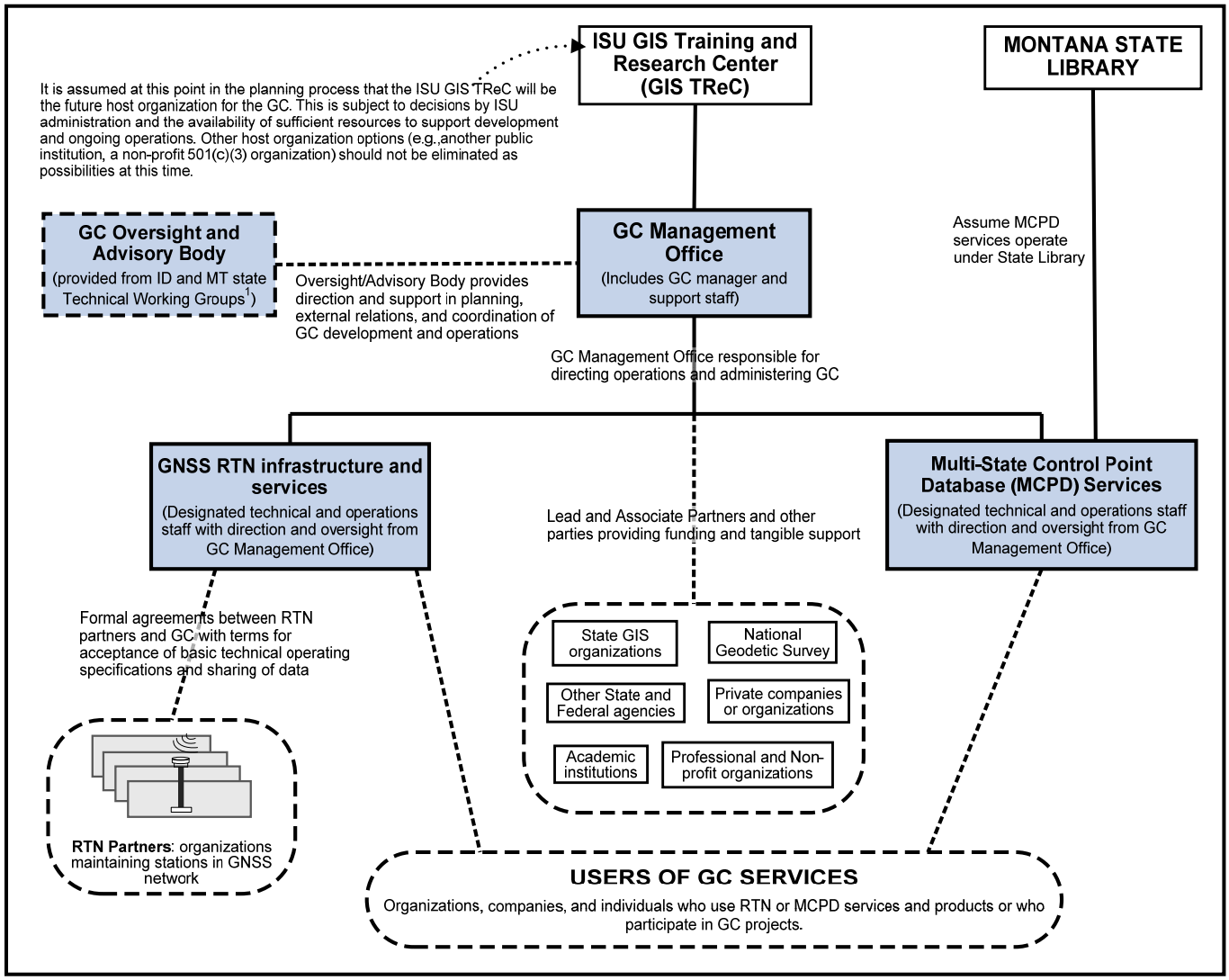
Parent organizations of GIS TReC and Montana Base Map Service Center (ISU administration and Montana State Library) will approve their complementary roles in GC development and operations and a written agreement with document that role and collaboration. A "management team" would be established by agreement and would be composed of personnel from the GIS TReC and the Montana State Library-Base Map Services. This body supports the collaborative nature of the informal structure and makes decisions, through consensus, on important issues affecting GC development and delivery of services. Also, a "GC Oversight/Advisory Body" would be identified. This body would be a committee selected from the membership of Technical Working Groups (TWGs) of Geodetic Control Working Groups in Idaho and Montana. One possible action that might encourage collaboration and sharing of resources is to formally merge these TWGs to create a multi-state body.

5.3.3 Formal GC Organizational Structure

When GC services and users have expanded and there are sufficient resources and organizational support, then the information organization described in 5.3.2 is formalized. As shown in Figure 8, the central part of this

formal structure is a GC Management Office, with an assigned manager and staff, which has responsibility for all GC operations and services. It is recommended that the GC Management Office be established within a host organization which has accepted this role. The host organization has not been identified but it could be Idaho State University, the Montana State Library, or another organization (government, academic, or private). It is an option, after the GC matures, to establish the GC Management Office as a separate, non-profit entity (IRS code 501(c)(3) organization) if this was deemed to be effective. At this point in the planning process, ISU's GIS TReC has been identified as a potential future host organization for the GC. If this is the case, ISU would take the leadership role(s) as given in Table 8. This is subject to decisions by ISU administration and the availability of sufficient resources to support development and ongoing operations. Other host organization options (e.g., another public institution, a non-profit 501(c) (3) organization) should not be eliminated as possibilities for future consideration. The GIS Oversight/Advisory body formed as part of the informal organizational structure would continue to exist with any needed restructuring or adjustments in membership.

Figure 8: Formal GC Organizational Structure



[1]Idaho and Montana State Geodetic Control Working Groups

5.4 Management Roles and Staffing

5.4.1 GC Management

The GC should have a manager with responsibility to oversee GC set-up and development, staff recruitment, work delegation and monitoring, handling of legal and financial matters, exploring and initiating new projects, and preparation of status reports. This manager is also the main interface with the Steering Committee, the parent organization, MCPD and GNSS/RTN personnel. In addition, this person or another management level person needs to play a role in GC outreach and promotion. Initially, it is expected that this management role will require about a 0.25 full time equivalent (FTE) but is expected to grow over time—perhaps to the point where a full-time manager is required.

5.4.2 Administrative Support

This function includes standard office administrative work including receptionist duties, handling and routing communications, setting up logistics and facilities for meetings, training sessions and other events, clerical tasks, inventorying and ordering supplies, and providing other support to management personnel and staff. It

is expected this role will require initially a 0.35 FTE allocation and additional resources as services and demand increases—with a need for at least one FTE after establishment of a formal GC management office.

5.4.3 Technical Personnel

This staffing category includes any personnel (including contractors) who provide technical or operational support for GC activities and projects. The main required skills include: a) Server/network administration and monitoring supporting the MCPD and RTN network, b) Web site maintenance, c) providing assistance with RTN station set-up and connection to the server, monitoring, and maintenance, d) MCPD and related application/service development and enhancement, e) technical training and communications, f) technical project management. The specific levels of staffing to fulfill these roles will begin modestly but grow overtime. It is expected this role will require, initially, at least a 0.50 FTE, and as services and demand increase, additional technical staff time will be needed In addition, there is the need for additional technical resources for review and acceptance (quality control) of submitted geodetic information—requiring staff with appropriate training and credentials in the surveying or related field.

5.4.4 Options for GC Management and Staff

With the expectation that initial and possibly ongoing funding for GC operations will be limited, filling GC staff roles should not rely on additional full-time dedicated positions but it should be recognized that full development and operation of the GC will require additional staff resources not currently available to the organizations leading the GC planning project and its initial operations (ISU GIS TReC and Montana Base Map Service Center). This means that funding will be required for management and technical personnel retained as employees or contract staff. In addition to specifically designated GC positions, operational and cost efficiency calls for maximum use of other staff resourcing approaches:

- Use of resources from the "host organization": To the extent possible, existing personnel of host organizations should fill GC management, administrative support, and technical staff—addressing requirements for additional funding to cover GC activities using available sources.
- Volunteer time: GC operations will always need and benefit from the donation of time from professionals in outside supporting organizations (potentially any public sector, private, or non-profit organization). Volunteer time should probably remain as informal as possible but there would be a need to identify, recruit, and monitor volunteers and their work.
- Student Interns: Employment of qualified undergraduate or graduate students from any college or university, on a short-term basis (for a brief project) or in a longer-term co-op or internship program. Costs for student labor could range from no cost to modest hourly pay rates. Such programs work best when there is a clear agreement with the college or university and when the experience and skills of candidates may be reviewed in the selection process.
- Donated Services from the Private Sector: In some cases, GIS and IT service vendors and consultants may be interested in providing donated services or support for GC development or for projects using GC services.
- Paid Contract/Project-based Personnel: When an GC sponsored or managed project is supported with appropriate funding (e.g., grant award), it is efficient to use some paid services from a private contractor (e.g., GIS consultant).

5.5 Operational Practices and Service Delivery

Establishment of the GC must be accompanied by a set of management and administrative practices that support GC operations, communications, and delivery of services. The main "core management practices" are

described below in Table 5. This is followed by Table 6 describing primary technical and administrative activities for the GC.

Table 5: GC Core Management Practices

Core Practice	Implementation/Operation Issues for the GC
Staff Recruitment and Oversight	Includes all work involved with identifying and hiring GC staff for any management, technical, or administrative role regardless of the personnel classification (e.g., student intern, part-time, volunteer, etc.) This is the primary role of the GC Manager. The role includes all administrative work in establishing a position, filling an existing position, or defining roles for personnel positions that are already part of the host organization. Oversight involves staff orientation, assignment of work, ongoing review of work and guidance, and evaluations.
Responding to Requests for Products or Services	The GC Manager or a technical staff person should be assigned for timely response to an inquiry and in appropriate steps to scope out and provide the requested product or service. The specific response will depend on the type of request and resource impacts of the GC. For requests that go beyond routine activities (signing up a new organization as a GC Member or providing access to a Web services), a "work ticket" should be created, the potential "project" should be scoped (define basic approach, result, and resources required) with a response to the requestor and possible initiation as a new project.
Outreach and Promotion	Promotion of GC programs and services is an on-going activity which is a key role of the assigned GC Manager (although specific activities may be assigned to other personnel). This includes distribution of information about the GC (primarily to organizations and individuals inside the GC region) through multiple channels (Web site, presentations at meetings, direct calls or email messages, distribution of promotional literature, etc). See Section 6.4 for more information about GC marketing and promotion.
Project Planning and Management	This Core Practice applies to cases in which the GC is called on to provide resources and expertise for a specific project (e.g., acting as a project manager for contracted database development services). For these cases, there should be a defined workflow and templates that support best practices for planning a project (defining tasks, schedule, and resources) and for ongoing management (project tracking, deliverable review, reporting).
Work and Financial Tracking	A routine function for which the GC manager is primarily responsible. This addresses established procedures, in the host organization, for employee time reporting (hours by project or activity area), employee expenses, and all routine accounting and bookkeeping work.
Scheduling Use of Facilities	Facilities of the host organization or an outside organization will be available to the GC for holding meetings and other events. Such facilities may be provided at no cost by the host or an outside organization or fees may be required. Whatever the circumstances, designated GC staff will have the responsibility for identifying appropriate facilities, scheduling their use, making sure that required set-up is being handled (room configuration, equipment), arranging for amenities (e.g., refreshments), attendee registration, etc.
Status Monitoring and Reporting	A basic responsibility of the GC Manager will be to track overall activity and progress during GC development and during operational Phases. This implies a formal reporting process based on requirements established by GC management and/or the host organization(s).

Table 6: Important Technical and Administrative Activities for GC and GNSS Operations

Activity	Description
Clerical and administrative support	Clerical and administrative support activities include receptionist functions, meeting scheduling and organization, handling of office communications, document preparation and management, support in promotional activities, support in purchasing supplies and other procurements, and other support provided to management and technical personnel and users.
System Administration	Includes all activity associated with acquisition, installation, configuration, and monitoring of all computer hardware (principally servers, storage units, and associated devices), network, and software acquisition, installation, configuration, upgrades, and monitoring. Also includes administration of agreements for hardware and software maintenance and support and network services.
Web site and systems administration	In-house or contracted work in the design and ongoing maintenance of the MCPD Website and services provided via the Web. Also included is maintaining the Website supporting access to GNSS data and services provided to users. This activity encompasses configuration and administration of the Web server software, Website design, and Web application development and deployment.
Subscription service administration	This includes all work involved in managing subscriptions to RTN and potential MCPD services: a) subscription applications and user registration, b) management of fees and payments, c) subscription renewal, and other related subscription management activities.
MCPD data intake and quality control	Covers all operational management and work associated with intake of geodetic data submittals, the review and approval of data submittals, technical support to submitters, and loading of data for MCPD access.
User support and training	All activities that involve user support and training. This includes response to calls or email messages with question and help requests, contributions to Web accessible documentation, on-line help tools, FAQs, etc. This also includes the preparation of education and orientation materials and user training.
Special project design and execution	All work associated with special projects that are undertaken by the GC. This includes project planning, assignment of project manager and team members, carrying out project work and producing deliverables, project status reporting, and project close out.

5.6 Development Phases

GC development and operation will be organized into the following phases:

Phase 1: Initial MCPD Enhancement and Preparation for Geopositioning Cooperative (GC) Formation (6 months from Business Plan Acceptance)

Phase 1 work includes identifying and establishing the initial formal structure of the GC (see 5.3) including necessary agreements and organizational entities required for initial operations. An important activity for Phase 1 is identification of external partners and funding sources that will support GC development and operation in future Phases. In addition, this Phase includes the continued operation and scheduled enhancements of the existing Multi-state Control Point Database (MCPD) with expanded submittals of data and continued work in server/software set-up for RTN support at the ISU GIS Center. Finally, an outreach and promotion program shall be designed and outreach activities initiated (to help increase awareness and identify sources of support for future GC operations).

Phase 2: Initial Geopositioning Cooperative and RTN Set-up and Additional MCPD Enhancement (24 months following end of Phase 1)

The initial GC organizational structure will be established in this Phase. As described in 5.3, this will be an informal structure that relies largely on agreements between existing organizations without creation of a formal "GC Management Office". This initial organizational structure is used as a foundation to continue development work begun in Phase 1 and to provide RTN and MCPD services to users. Procedures and templates for implementation of Core Management Practices (see Table 4) are put in place. An active campaign to sign-up subscription-based users is carried out. As resources allow the RTN of GNSS stations is expanded (including incorporation of base stations established and maintained by multiple organizations) and the MCPD operations continue with expanded data submittals and users. Outreach and promotion

activities continue and additional partners, providing monetary or non-monetary support, are secured. Also, project collaboration opportunities are explored (with one or more confirmed if possible).

Phase 3: Expansion and Formalization of Geopositioning Cooperative Services and RTN (24 months following end of Phase 2)

In this Phase, a more formal management and administrative structure for the GC (see 5.3) will be put in place and necessary management and staff resources will be assigned. Additional GC services and programs are developed and deployed. Planned MCPD system and service enhancements are made and service volume is expanded. Additional base stations are established by other organizations within the two-state region resulting in nearly full coverage for the most active areas of the region and the GNSS station network is fully maintained. New funding sources and partnerships are established and sustained funding and staffing levels are secured for ongoing operations. The GC is actively involved in collaboration with outside organizations and approved special projects.

Phase 4: Mature Geopositioning Cooperative Services and RTN Operations (Future after Phase 3)

The management structure and management processes are well established and are improved or augmented as necessary. Sources of funding and in-kind support are in place but work for identification and securing of new sources is ongoing. MCPD operations continue and the RTN stations are added to provide full coverage for the multi-state region. Outreach and promotion continues and the GC (including MCPD) services expand to serve a larger community and higher volume of requests.

There will be a continued need to maintain and upgrade equipment and capabilities. For instance, all base stations participating in the network will need to be GNSS capable instead of GPS-only. New base stations deployed after 2012 should be GNSS-compliant, but older base stations will need to be upgraded to achieve this capability. It is anticipated that the Idaho-Montana RTN will be fully GNSS-compliant by the year 2020. The GC may have direct responsibility for establishing, configuring, and maintaining some base stations but it will have a primary role in coordinating with other organizations (e.g., government agencies and private companies) to integrate base stations which they maintain into the RTN. Network readjustments will need to be completed occasionally and a three-year readjustment cycle is anticipated. This readjustment will involve the RTN System Administrator, a licensed surveyor, and geodetic advisor.

6. PROPOSED IMPLEMENTATION STEPS, TIMING, RESOURCE REQUIREMENTS

6.1 Implementation and Operation Tasks, Timing and Responsibilities

Implementation activities associated with the four recommended GC development phases are identified and described in Table 6. These implementation tasks are organized under the following categories:

- OR: Establishment and Set-up of Organizational and Governance Structure
- FS: Securing and Sustaining Funding and External Support
- MC: MCPD Enhancement and Operations
- RT: RTN Technical Design, Development, and Operation of Services
- OP: GC Outreach, Promotion, and External Collaboration
- SP: Special Project and Service Delivery
- OM: Ongoing GC Management

Table 7 describes key tasks for GC implementation and operation.

Table 7: Tasks and Timing for GC Implementation and Operations

Task Number and Name	Explanation	Phase[1]	Main Deliverables/Milestones
OR: Establishment and Set-up of Organizational and Governance Structure			
OR1: Receive formal acceptance of *Business Plan*	While there is no single organization from which there is required acceptance of the *Business Plan*, there are some key stakeholder organizations from which formal acceptance, or at a statement of acknowledgement or support, would be useful as a starting point for moving ahead with initiatives identified in the plan. Completion of the plan by the project team and submittal to the FGDC CAP Grant Fifty States Initiative Category Lead is the initial step in formal acceptance. The project team will respond to any request from the FGDC for revisions to the *Business Plan* and it will then be finalized and formally accepted. Following this, the project team will request formal acceptance by the following organizations: • Idaho Geospatial Council Executive Committee • Montana Land Information Advisory Council • Montana State Library • Idaho State University Geospatial Coordinating Committee • National Geodetic Survey • Idaho Geodetic Control Technical Working Group • Idaho Cadastral Reference Technical Working Group • Montana's Geodetic Control Workgroup	1	• Final *Business Plan* submitted to FGDC • Final *Business Plan* with revisions based on FGDC comments • Final *Business Plan* submittal to key stakeholders • Statements or approval/acceptance from stakeholder organizations
OR2: Present to and Get support of host organizations for Initial operations	Provide necessary briefings and presentations to initial host organizations (Montana State Library and Idaho State University) and get support for ongoing operations and development work during Phase 2.	1	• Briefing materials and meetings with host organizations • Formal statement of support from host organizations
OR3: Assign GC Management Team for initial operations	Formal assembling of the GC management team composed of current management personnel in the Montana State Library and the ISU GIS Training and Research Center. This includes identification of specific individuals and their roles.	1	• Document that establishes the management team and assigns roles
OR3: Establish agreement between host organizations	Creation of formal agreement between the host organizations: ISU and the Montana State Library. This would take the form of a memorandum of agreement between the ISU and the Montana State Library. This agreement makes reference to the approved *Business Plan*, the roles assigned to the Management Team (see OR3), and the responsibilities of and organizational relationships between the host organizations for Phase 1 and Phase 2	1	• Draft agreement • Final signed agreement
OR4: Form GC Oversight Body	The first step of this task is to prepare a formal document that describes the role, responsibility, composition, and operational rules of the Oversight Body. With involvement and approval of Montana's and Idaho's statewide GIS coordination bodies (i.e., Montana Land Information Advisory Council, Idaho Geospatial Council), an Oversight Body would be formed drawing mainly on membership of the existing work groups in each state (Idaho Geodetic Control Working Group and Montana Geodetic Control Workgroup) but other individuals may be invited to participate. The Body will be formally set-up and its work will be initiated.	1	• Document that defines role, responsibility, composition, and operational rules • Establishment of Body and assignment of members
OR5: Establish/Document services and procedures for operations in Phase 2	Preparation of a document that describes services (see Table 4) and key operational procedures for the GC focusing on near-term, Phase 2 operations. This is a living document which is continually added to and revised as needed.	1	• GC Procedures and Operations documents • Revisions as needed

Task Number and Name	Explanation	Phase[1]	Main Deliverables/Milestones
OR6: Define roles and assign GC staff for Phase 1 and Phase 2	Documentation of staff roles focusing on operations during Phase 1 and Phase 2. Staff positions follow recommendations provided in the *Business Plan*. This documentation identifies, existing personnel in the host organizations (ISU and Montana State Library) who can fill these roles as well as planned positions which existing staff cannot fill and for which resources (money or "borrowed staff" from and outside organization) is necessary.	1	• Documentation of staff positions and roles • Identification of existing staff who may fill staff roles
OR7: Prepare detailed budget and resources needs for Phase 2	Create a formal budget for GC operations in Phase 2—including MCPD and RTN operations in Idaho and Montana. This budget (following general categories shown in Table 9) should identify which items are already funded in whole or in part (by the host organizations or other parties) and items which are not currently funded. The budget should be reviewed and approved by the GC Oversight Body	1	• Phase 2 budget
OR8: Define roles and assign GC staff for Phase 3 and 4	Documentation of staff roles focusing on operations during Phase 3 and Phase 4. This will be a revision from the staff role document prepared in Phase 1. Staff positions follow recommendations provided in the *Business Plan*. This documentation identifies, existing personnel in the host organizations (ISU and Montana State Library). Staff positions created in Phase 2 which may continue, and new positions needed for Phases 3 and 4.	2	• Documentation of staff positions and roles—revised from Phase 1 • Identification of existing staff who may fill staff roles •
OR11: Identify host organization for future GC operations	Identify the host organization for GC operations in Phase 3 and subsequent phases. This is part of the establishment of the formal organizational structure shown in Figure 8. This will require consideration of different host options, discussions with these host organization candidates, garnering necessary support, and formal acceptance of the host role by an appropriate organization. Formal approval is provided by the Oversight Body.	2	• Identification of host organization candidates • Determination of host organization and formal acceptance of role • Approval by Oversight Body
OR12: Prepare workplan for Phase 3 transition	Preparation of a detailed work plan that identifies tasks, timing, responsibilities for making the transition to Phase 3. This workplan addresses all aspects of the transition from the informal structure set up for Phase 2 operations to a more formal organizational structure. It addresses changes in organizational structure, host organization, management, staffing, and funding sources. The plan will be prepared by the GC Management Team and approved by the GC Oversight Body.	2	• Draft workplan • Final workplan and approval by Oversight Body
OR13: Create GC Management Office	Based on tasks defined in the transition workplan (OR12), formally establish and set-up the GC Management Office supporting operations in Phase 3 and subsequent phases. This includes formal creation of the office inside the host organization determined in OR11.	2, 3	• Establishment of GC Management Office
OR14: Revise documented services and procedures for operations in Phase 3 and 4	Revision of the document prepared in OR5 for Phase 2 operations) to reflect changes and needs for subsequent phases.	1	• Revised GC Procedures and Operations documents
OR15: Revise organizational agreements	Revision of the initial agreement established in OR3 defining joint host organization responsibilities (ISU, Montana State Library) in Phase 1 and Phase 2. With the establishment of a primary host in Phase3, this initial agreement will be revised to reflect changes and continue roles of and relationships between these organizations.	2, 3	• Revised agreement
OR16: Realign Oversight/Advisory Body as required	With the creation of a more formal organizational structure for Phase 3 operations, there may need to be changes to the GC Oversight Body created in OR4. This task includes revision to the formal document defining role, responsibility, composition, and operational rules of the Oversight Body that may be required. In addition, membership changes are made.	2, 3	• Formal revision of document on role, responsibility, composition, and operational rules • Changes to membership
OR17: Assign GC Manager	Assign a GC Manager as the lead person of the GC Management Office created in OR13.	3	• Assignment of GC Manager

Task Number and Name	Explanation	Phase[1]	Main Deliverables/Milestones
OR18: Prepare detailed budget and resources needs for Phase 3	Create a formal budget for GC operations in Phase 3. Operations in Idaho and Montana. This budget should identify which items are already funded in whole or in part (by the host organizations or other parties) and items which are not currently funded. The budget should be reviewed by the GC Oversight Body. It must follow the budget format and budget approval procedures of the host organization determined in OR11.	2	• Phase 3 budget
OR19: Assign GC Technical and support staff for Phase 3 and beyond	Specific individuals are assigned to staff roles for Phase 3 as defined in OR8.	2, 3	• Staff assignments
OR20: Prepare detailed budget and resources needs for subsequent phases	As in OR18, budgets for future phases will be prepared, on an annual basis.	3	• Phase 4 budget
FS: Securing and Sustaining Funding and External Support			
FS1: Develop marketing strategy for specific vertical sectors	Preparation of a strategy and workplan that identifies funding sources and solicits funding and non-monetary support from key sectors: local governments, state/federal govt, universities, private sector users, private sector equipment and service providers. This workplan addresses key elements of a sustainable resourcing and funding environment for the GC: a) host organization(s), b) small number of "Lead Partners" providing substantial funding, c) RTN participants agreeing to incorporate their maintained stations in the network , d) "Associate Partners" providing additional funding or material support at levels below the "lead partners".	1	• Draft workplan and review by Oversight Body • Final workplan
FS2: Prepare template partnership agreement(s)	Prepare template agreement documents with partnership terms for Lead Partners, RTN Participants, and Associate Partners.	1	• Draft agreement template and review by Oversight Body • Final template
FS3: Identify Lead Partners for Phase 2.	An important goal is to identify a small number of organizations who can provide tangible resources for GC development and ongoing operations for Phase 1 and future phases. This task includes identifying potential partners, approaching them, getting commitments for support.	1	• Identification of Lead Partner candidates • Commitments from several Lead Partners
FS4: Identify RTN Participants for Phase 2	Identify and get commitment from organizations (public or private sector, universities) which maintain base stations (which do or could meet required specifications) for participation and incorporation into the GNSS RTN. Potential participants include the NGS, State Transportation agencies in Idaho and Montana, selected local governments, agricultural service companies and associations, and other public and private sector organizations.	1	• Identification of potential RTN participant organizations • Commitments from several Lead Partners
FS5: Identify Associate Partners for Phase 2.	Associate Partners are organizations (public or private sector, non-profit) that have made a commitment to provide some funding or tangible resources (staff time, equipment, etc.) to support the GC but at a lower level than the "Lead Partner" organizations. This task involves identifying possible candidates. Approaching these candidates and working out the type of support that may be provided, and getting commitments from the partner organizations.	1	• Identification of Associate Partner candidates • Commitments from several Associate Partners
FS6: Ratify Partnership Agreements for Phase 2.	Prepare and get signed agreements with Lead Partners, RTN Participants, and Associate Partners identified in FS3, FS4, and FS5. Agreements are template agreement(s) prepared in FS2.	1	• Draft agreements for partners • Negotiations and revisions to agreement terms • Final ratified agreements

Task Number and Name	Explanation	Phase[1]	Main Deliverables/Milestones
FS7: Establish grant research and application function	Put in place a process and assigned personnel for the research, identification, and preparation of grant applications which may support GC activities. Grant programs may be administered by Federal or State agencies, or non-governmental organizations. In some cases, the GC may play a lead role in grant application (often assembling a proposed team for resulting work) or it may be a party to a grant project led by another organization. Establishing an effective grant research and application program requires coordination with individuals already involved in this work.	1	• Grant research program in place • Selected grant applications and award
FS8: Establish/Leverage Student Intern Program	The GC Manager will position the GC to take advantage of available student intern or co-op programs and, as necessary, establish new relationships with colleges and universities with GIS programs.	1, 2	• Hired student interns
FS9: Add/Renew Lead Partners for Phases 3 and 4	Identify and get commitment from additional Lead Partners following initial Lead Partners established in FS3. Also includes renewing agreements with existing Lead Partners.	2, 3, 4	• Ratified agreements with new Lead Partners • Renewed Agreements with existing Lead Partners
FS10: Add/Renew RTN Participants for Phases 3 and 4	Identify and get commitment from additional Lead Partners following initial Lead Partners established in FS4. Also includes renewing agreements with existing RTN Participants.	2, 3, 4	• Ratified agreements with new RTN Participants • Renewed Agreements with existing RTN Participants
FS11: Add/Renew Associate Partners for Phases 3 and 4.	Identify and get commitment from additional Lead Partners following initial Lead Partners established in FS5. Also includes renewing agreements with existing Associate Partners.	2, 3, 4	• Ratified agreements with new Associate Partners • Renewed Agreements with existing Associate Partners
FS12: Ongoing work securing future funding and resources	Research and securing of funding and non-monetary resources to support the GC will be an on-going activity and a principal role of the GC manager.	ALL	• New identified funding sources • Direct appeals to sources • Secured funding
MC: MCPD Enhancement and Operations and Control Point Data Gathering			
MC1:Initial release of the MCPD	Replace Montana Control Point Database with the Multi-State Control Point Database at Montana State Library. This includes enhancements to the application that are being completed in the 1st Qtr of 2012.	1	• Deployed application with enhancements
MC2: Establish Data Steward	Establish a data steward position, recruit and assign a person (as salaried or contract staff). This position would oversee submittals and use of the MCPD data including work on quality control and approval of submitted data. This position would also provide customer support for users and technical feedback to data suppliers. As called for in this plan, this person, ideally, would be a certified PLS or at a minimum have adequate training and credentials to serve this role.	1, 2	• Position created and filled
MC3: Establish System administrator/database administrator	Identify and hire a system administrator or database administrator to monitor, maintain, and service the server and software for the MCPD.	1,2	• Position created and filled
MC4: Provide ongoing service and support users	This task encompasses all the routine service delivery activities for MCPD users including establishing user accounts, providing MCPD access, answering questions, and providing other user support.	ALL	• Ongoing service to users
MC5: Monitor system use	Use Web-based statistics monitoring and supporting tools to periodically identify volume and type of use and generate reports (best on a quarterly basis) and distribute to GC management personnel.	2, 3, 4	• Periodic usage reports

Task Number and Name	Explanation	Phase[1]	Main Deliverables/Milestones
MC6:Review MCPD application and Identify needed enhancements	Review the MCPD application and determine if any enhancements or changes need to be made. Write up necessary scope of work for those changes.	2, 3, 4	• Documented fixes and enhancements for implementation
MC7: Review physical location of application	Determine if housing the application at the Montana State Library is advantageous or should it be moved to co-locate with GNSS RTN management at the ISU GIS TreC.	2,3	• Decision on future location
MC8: Design and make enhancements to MCPD applications	As required, carry out enhancements to the MCPD application or background database structure that may be required and identified in MC5. Enhancements may be fixes to minor operational problems that are discovered or more major modifications to functionality to address technology platform requirements or additional needs of users.	2, 3, 4	• Deployed application with enhancements
MC9: Research existing sources of existing geodetic control data	With the objective of making the MCPD a comprehensive source of geodetic control data for the Idaho-Montana region, this task involves research into existing sources of data—public sector and private organizations that are gathering control data and which might submit data to the MCPD. As part of outreach activities in OP5, the research will focus on the land surveying community, private engineering firms, as well as federal, state, and local governments.	1, 2	• Identification of organizations and sources of control data
MC10: Gather and collect geodetic control data for submittal to MCPD	After identifying and getting commitments from organizations gathering geodetic control data, this task involves ongoing work to gather and accept these data for inclusion in the MCPD.	2, 3, 4	• Ongoing collection/submittal of data for multiple sources
MC11: Make upgrades and reconfiguration of MCPD server and network	Make changes and improvements to the system configuration as required to address performance or functionality issues. This includes server and storage hardware upgrades and operating system configuration, network improvements, improvements to data backup processes, enhancements to security controls, and other system upgrade or configuration changes.	3, 4	• Procurement of products or services • Upgraded or reconfigured system
RT: RTN Technical Design, Development, and Operation of Services			
RT1: Deploy server hardware to support RTN	The GIS TReC at Idaho State University has invested in a server and network infrastructure to support the development of an RTN for the region. This server is a multi-core Windows 2008 (OS) server with 8 GB RAM and gigabit Ethernet connectivity to the university's network backbone.	1	• Operational server
RT 2: Develop specifications for new base stations	The GIS TReC will develop a document describing minimum specifications for base stations included in the GC network. This will include antenna mounting requirements, maintenance expectations, etc.	1	• Completed, documented specifications
RT3: Prepare template service level agreement	The GIS TReC will prepare a draft service level agreement for distribution to potential end-users.	1	• Template service agreement with appropriate annotation for use in specific cases
RT4: Develop end-user commitments (MOA)	Memorandums of understanding and memorandums of agreement will be drafted and executed between ISU's GIS TReC and end-user organizations describing the level of service to be provided by the RTN, the roles of each party, and the financial obligations of end-users to support the RTN. Initial MOA's should be signed for a minimum of two-year commitments.	ALL	• Ratified MOAs with users
RT5: Establish System administrator/database administrator	Identify and hire a system administrator or database administrator to monitor, maintain, and service the server and software for the RTN.	1,2	• Position created and filled
RT6:Purchase, install and configure RTN server software	Following the development and execution of MOA's (above) RTN server software will be purchased following appropriate purchasing channels, rules, and regulations.	1,2	• RTN server software installed and functional to provide modeled network solutions

Task Number and Name	Explanation	Phase[1]	Main Deliverables/Milestones
RT7:Initiate RTN services in east Idaho	The deploy a functional RTN requires a minimum of four high accuracy base stations operating within 50km of each other and with a suitable geometry (i.e., a non-linear geospatial geometry). East Idaho is most advanced in this development and is ready for RTN deployment.	2	• Initial east Idaho RTN services in operation
RT8: Put in place structure and process for service subscription fees	Once the RTN and necessary MOA's are in place the long-term sustainability of the RTN needs to be revisited. Additional end-users need to be identified and added to the user base as well as plans made for expansion of the RTN throughout the region.	1,2	• Documented user fee terms and process
RT9: Provide ongoing service and support to RTN users	This task encompasses all the routine service delivery activities for RTN users and partners including establishing user subscriptions, providing access to RTN services, answering questions, and providing other user support.	ALL	• Ongoing service
RT10: Expand RTN station access beyond east Idaho	Through partnerships with outside organizations as well as the establishment of new RTN stations by the GC (resources permitting), incrementally expand the RTN network coverage beyond the initial east Idaho region to cover all areas of Idaho and Montana.	3, 4	• Expanded network in operation
OP: GC Outreach, Promotion, and External Collaboration			
OP1: Design and set-up initial GC Website	An initial GC Web page will be established on a designated server. In Phase 1, this will just provide basic functionality (background information, contacts, promotional material, etc.) as well as a link to the MCPD and GNSS services. As GC services expand, the site will provide access to a larger range of resources and GC services. As part of this task, a documented design should establish basic Web Site format and look-and-feel.	1, 2	• Main GC Web page with GC information and links
OP2: Prepare GC promotional materials	Includes the development of a GC brochure that explains the GC concept, the existing and future intended services, opportunities for partnerships, contact information, etc. The main audience includes potential partners and users. Recommended design would be a two-sided letter size sheet or tri-fold in 3 or 4 colors. It should be designed so it can be distributed in hard copy and digital form.	1, 2	• Final brochure
OP3: Identify and arrange for presence at key events and meetings	On a continuing basis, identify and arrange for participation at key meetings and events that support GC operations. This includes in-person and remote participation in such events as professional conferences, meetings with industry groups, state GIS council and working group meetings, conferences of professional meetings, events sponsored by Lead or Associate Partners.	ALL	• Running list of potential meetings and events • Participation in selected meetings and events
OP4: Conduct target outreach for vertical partners	This task addresses the marketing strategy prepared in FS1. It includes all outreach and promotion work with potential Lead and Associate Partners and work with them leading to commitments for funding and support.	ALL	• Identified potential partners • Contact and communication with potential partners leading to commitments
OP5: Identify and put in place data sharing relationships with geodetic control data sources	In conjunction with research work carried out in MC8, contact will be made with public sector and private organization sources of geodetic control data for inclusion in the MCPD. This includes engaging the land surveying community, private engineering firms, as well as federal, state, and local governments.		• Commitments by organizations to regularly submit data to the MCPD
OP6: Define subscriber terms and categories	Definition of terms for user subscriptions for standard GC services which may include access to MCPD services and/or RTN GNSS services. This will include defining several categories of services, associated fees, and specific terms for use. The result is a series of template agreements for the different subscriber categories.	1	• Template subscriber agreements
OP7: Prepare subscriber recruitment materials	Preparation of materials for recruiting subscribers. This includes content for the GC Web Site, documents/flyers for digital or hardcopy distribution, and presentation materials to use at meetings and events.	1	• Recruitment materials

Task Number and Name	Explanation	Phase[1]	Main Deliverables/Milestones
OP8: Conduct active, ongoing subscriber recruitment campaign	Conduct an active campaign of advertising, promotion, and direct marketing to attract and sign-up subscribers for the GC services.	ALL	• Added subscribers
OP9: Promote special project service offerings	Based on special project offerings identified in SP1, actively promote and market GC special projects which are suited to the capabilities of GC resources and staff. The GC may take on special projects in a sole or lead capacity or may provide support in a team lead by another organization.	ALL	• Special project promotional materials • Direct marketing for special projects
OP10: Conduct periodic user satisfaction surveys	On a periodic basis (no more frequently than annually), after Phase 2, the GC Manager should conduct a survey of GC users to gain input about their experiences in use of GC services, level of satisfaction with the services, and suggestions for improvement and enhancement. This should be a well-designed Web-based survey with "back end tools" to process and present the results—which should be used to operational planning and improvement of services. To ensure an adequate response, the survey should be well advertised with enough lead time for individuals to respond.	3, 4	• Web-based user survey • Compiled survey responses
SP: Special Project and Service Delivery			
SP1: Identify special project offerings	The GC management team will identify types of special projects (e.g., support in base station design and set-up, use of geodetic control data for mapping projects) as one element of GC service offerings. The list of special project types which the GC is equipped to handle will expand over time. Each special project type will be described in terms of objectives, services, deliverables, and types of organizations that may use the service.	ALL	• List and description of special projects (expanded over time)
SP2 Set-up management structure for new projects	The GC will be positioned to assume a role in the planning and management of special projects for GC users who request project support. Initiating special project will require setting up a project management structure consisting of a work plan, schedule, budget, definition of deliverables, project manager and team, project communications and monitoring, and reporting. This task involves establishing basic standards and templates for project planning, execution, and management	2	• Documented project management standard procedures • Templates (project plan, project status report)
SP3: Accept new special projects and negotiate terms	Includes finding new project prospects, investigating project requirements, writing a proposal as necessary, and securing a commitment from the project client including preparation of a contract or agreement defining required project services.	2, 3, 4	• New project accepted • Ratified contract or agreement
SP4: Assign manager and team for each special project	A project manager and team members are assigned. These personnel may draw on GC staff or individuals from other organizations.	2, 3, 4	• Assigned manager and team
SP5: Prepare project plan for each special project	The project manager has the lead role in preparing a project plan that defines tasks, deliverables, timing, resource requirements, and roles for team members. The plan follows standards and templates prepared in SP2	2, 3, 4	• Completed project plan
SP6: Execute project	The project is executed according to the plan prepared in SP5. Deliverables are prepared and provided to the client who reviews and accepts them after any required revision.	2, 3, 4	• Project work and deliverables completed
SP7: Monitor and report on project status	The project manager, supported by the project team monitors progress and prepares periodic status reports for GC management and the client.	2, 3, 4	• Status reports
SP8: Close out project	A final closeout report will be prepared for each project that summarizes work completed, deviations from the initial plan, and lessons learned. Formal acceptance is provided by the client.	2, 3, 4	• Formal closeout and client acceptance
OM: Routine GC Management and Operations	This includes routine GC management and operational activities that will begin in Phase 2 and continue in subsequent phases. Many of the activities here address the management and operations practices and activities described in Tables 5 and 6. These follow procedures defined in OR5 and OR14.		

Task Number and Name	Explanation	Phase[1]	Main Deliverables/Milestones
OM1: On-going staff/personnel management	This activity encompasses all routine staff management work carried out by the GC Management Team/Manager or by staff who are assigned project management roles. This includes new employee orientation, work delegation and oversight, employee evaluation, periodic staff meetings, and disciplinary actions as appropriate. These activities follow established personnel rules of the GC host organization(s).	2, 3, 4	• Staff recruitment and hiring • Staff orientation • Delegated staff assignments • Staff evaluations • Staff meetings
OM2: Monitor/Manage GC time and finances	The GC Management Team (Phase 1) and GC Manager (subsequent phases) will be responsible for tabulating, preparing, and reviewing necessary forms required by the host organization and by any external organizations providing funding or in-kind support (e.g., grant administration requirements). This includes employee time and expense reporting, preparation of purchase requests, review and approval of invoices, and other financial tracking and reporting requirements.	2, 3, 4	• Staff time and expense reporting • Financial reports
OM3: System administration and support	This includes all routine administration, monitoring, and support for hardware, software, networks, and applications supporting GC operations.	ALL	• Ongoing system monitoring reporting • Routine system configuration and tuning • System upgrades
OM4: Monitor GC activities and service delivery	This includes all routine monitoring of GC activities and services. It includes the capture of basic metrics (e.g., members recruited, number of requests for service, project reports, special events managed, fundraising results, etc.).	ALL	• Logs and reports
OM5: Prepare detailed management reports	Periodic reports aimed at management personnel from the host organization, the IGO, and management in other organizations providing significant funding and support should be prepared on a regular basis (e.g., monthly or quarterly depending on the requirements of the recipient parties). This reporting will use template documents prepared during GC set-up.	ALL	• Management reports
OM6: Manage meetings and communications with Oversight Body	GC management will be responsible for providing support in setting up periodic meetings of the GFRC Oversight Body. Also, GC management will communicate as necessary with the Oversight Body on an ongoing basis.	ALL	• Meeting organization and participation • Routine communications
OM7: Prepare bi-annual status reports	Using a reporting template, bi-annual reports, aimed at management personnel and key stakeholder organizations, are brief summaries of accomplishments during the reporting period against GC goals, and provide summary statements of key accomplishments, problems, resource needs, and events. These reports are distributed in digital form and used, as required, for management briefings.	ALL	• Quarterly reports
OM8: Schedule and handle logistics for GC meetings and events	GC staff or volunteers will handle scheduling and arrangement of facilities for meetings and events sponsored or supported by the GC. This is one of the core administrative functions described in Table 5.	ALL	• Meeting set-up
OM8: Periodic review and audit of GC operations	Effective GC management calls for period reviews or “program audits” carried out to provide a comprehensive picture of program status, quality of service, accomplishments, and problems or obstacles encountered. Carrying out a review on an annual basis provides information useful in planning for future operations and improving services to users.	3, 4	• Audit reports

[1] When more than one Phase is shown, it means that either: a) the task begins in one phase and is completed in the other OR b) the task is ongoing in nature and is carried out during multiple phases

6.2 Implementation Responsibilities

Table 8 identifies specific offices or groups that have responsibility for GC development and operational activities. Three role/responsibility categories are identified:

- Lead Role (L): Overall responsibility for accomplishing or carrying out the activity including detailed work planning, assembling and overseeing work teams, work monitoring and quality checks, etc.
- Participant/Support (P): Any involvement in carrying out the activity, providing technical or management assistance, or system resources to support the work.
- Oversight/Approval (O): Designated role in oversight and formal approval for GC development and operations

Table 8: Responsibilities for GC Development and Operation

	Responsibilities (L=Lead Role, P=Participant/Support, O=Oversight/Approval)													
GC Development Task	Montana State Library/Base Map Services	Idaho State University Admin	Montana Land Information Advisory Council	Idaho Geospatial Council-executive committee	ISU GIS Training and Research Center	State Technical Work Groups/Advisory Body[1]	GC Management Team/Management Office	State and Local Agencies	NGS and Federal Agencies	RTN Participants	Control Data Participants	GC Partners/Sponsors	GC Staff/Project teams	GC Vendors /Contractors
OR: Establishment and Set-up of Organizational and Governance Structure														
OR1: Receive formal acceptance of *Business Plan*	**O**	**O**	**O**	**O**	**P**									
OR2: Present to and get support of host organizations for initial operations	**O,L**	**O**			**L**	**P**								
OR3: Assign GC Management Team for Initial operations	**O,L**	**O**	**P**	**P**	**L**	**L**	**P**							
OR3: Establish agreement between host organizations	**O,L**	**O**	**P**	**P**	**P**									
OR4: Form GC Oversight Body	**O,L**	**O**	**P**	**P**	**L**	**L**	**L**							
OR5: Establish/Document services and procedures for operations in Phase 2	**O,L**	**O**	**P**	**P**	**L**	**P**	**P**						**P**	
OR6: Define roles and assign GC staff for Phase 1 and Phase 2	**O,L**	**O**					**L**						**P**	
OR7: Prepare detailed budget and resources needs for Phase 2	**O,L**	**O**					**L**						**P**	
OR8: Define roles and assign GC staff for Phase 3 and 4	**O,L**	**O**					**L**						**P**	
OR11: Identify host organization for future GC operations	**O,L**	**O**	**P**	**P**			**L**						**P**	
OR12: Prepare workplan for Phase 3 transition	**O**	**O**	**O**	**O**	**O**	**O,P**	**L**						**P**	
OR13: Create GC Management Office	**O,L**	**O**	**P**	**P**	**O,P**	**O,P**	**L**						**P**	
OR14: Revise documented services and procedures for operations in Phase 3 and 4	**O,L**	**O**	**P**	**P**	**L**	**P**	**P**						**P**	
OR15: Revise organizational agreements	**O**	**O**	**O**	**O**	**O**	**L**	**L**							
OR16: Realign Oversight/Advisory Body as required	**O**	**O**			**O**	**L**	**L**							
OR17: Assign GC Manager	**O**	**O,L**			**L**	**O**	**L**							
OR18: Prepare detailed budget and resources needs for Phase 3	**O,L**	**O**					**L**						**P**	
OR19: Assign GC technical and support staff for Phase 3 and beyond	**O,L**	**O**					**L**						**P**	

GC Development Task	Responsibilities (L=Lead Role, P=Participant/Support, O=Oversight/Approval)													
	Montana State Library/Base Map Services	Idaho State University Admin	Montana Land Information Advisory Council	Idaho Geospatial Council-executive committee	ISU GIS Training and Research Center	State Technical Work Groups/Advisory Body[1]	GC Management Team/Management Office	State and Local Agencies	NGS and Federal Agencies	RTN Participants	Control Data Participants	GC Partners/Sponsors	GC Staff/Project teams	GC Vendors /Contractors
OR20: Prepare detailed budget and resources needs for subsequent phases	O,L	O					L						P	
FS: Securing and Sustaining Funding and External Support														
FS1: Develop marketing strategy for specific vertical sectors	P		P	P	L	P								
FS2: Prepare template partnership agreement(s)	L				L	P	L					P		
FS3: Identify Lead Partners for Phase 2.	P		P	P	P	O	L					P	P	
FS4: Identify RTN Participants for Phase 2	P				P	O,P	L	P	P	P			P	
FS5: Identify Associate Partners for Phase 2.			P	P	P	O	L					P	P	
FS6: Ratify Partnership Agreements for Phase 2.	O	O	P	P	P	O	L					P	P	
FS7: Establish grant research and application function	P			P	P	P	L						P	
FS8: Establish/Leverage Student Intern Program	P	P				O	L						P	
FS9: Add/Renew Lead Partners for Phases 3 and 4	P		P	P	P	O,P	L					P	P	
FS10: Add/Renew RTN Participants for Phases 3 and 4	P					O,P	L	P	P	P				
FS11: Add/Renew Associate Partners for Phases 3 and 4.	P		P	P		O	L					P	P	
FS12: Ongoing work securing future funding and resources	P		P	P		O	L	P	P				P	
MC: MCPD Enhancement and Operations														
MC1:Initial release of the MCPD	L				P									
MC2: Establish Data steward	L				L		P							
MC3: Provide ongoing service and support users	L		O	O	P	O	P						P	
MC4: Monitor system use	L					O	P							
MC5:Review MCPD application and Identify needed enhancements	L					P	P							
MC6: Review physical location of application	L	O	O		L	P	L						P	
MC7: Design and make enhancements to MCPD applications	L					P	L					P	P	
MC8: Research existing sources of existing geodetic control data	L		P	P	L	P	O				P		P	
MC9: Gather and collect geodetic control data for submittal to MCPD	L		P	P	L	P	O				P		P	
MC10: Make upgrades and reconfiguration of MCPD server and network	L					O	L						P	P
RT: RTN Technical Design, Development, and Operation of Services														
RT1: Deploy server hardware to support RTN		O			L		P						P	P
RT 2: Develop specifications for new base stations					L		P						P	P
RT3: Prepare template service level agreement	P					O,P	L						P	P
RT4: Develop end-user commitments (MOA)	P					O,P	L	P	P	P			P	P
RT4: Develop end-user commitments (MOA)	P				P	O	L	P		P		P		
RT5: Establish System administrator/database administrator	P				P	O	L						P	P
RT7:Initiate RTN services in east Idaho		O				O	L			P		P	P	P

GC Development Task	Responsibilities (L=Lead Role, P=Participant/Support, O=Oversight/Approval)													
	Montana State Library/Base Map Services	Idaho State University Admin	Montana Land Information Advisory Council	Idaho Geospatial Council-executive committee	ISU GIS Training and Research Center	State Technical Work Groups/Advisory Body[1]	GC Management Team/Management Office	State and Local Agencies	NGS and Federal Agencies	RTN Participants	Control Data Participants	GC Partners/Sponsors	GC Staff/Project teams	GC Vendors /Contractors
RT8: Put in place structure and process for service subscription fees	**P**	**O**				**O**	**L**						**P**	
RT9: Provide ongoing service and support to RTN users	**P**	**O**			**P**		**L**						**P**	
RT10: Expand RTN station access beyond east Idaho		**O**				**O**	**L**			**P**		**P**	**P**	**P**
OP: GC Outreach, Promotion, and External Collaboration														
OP1: Design and set-up initial GC Website	**P**				**L**	**P**	**O**							**P**
OP2: Prepare GC promotional materials	**L**	**O**			**L**	**P**	**O**							
OP3: Identify and arrange for presence at key events and meetings	**P**		**P**	**P**	**P**	**P**	**L**	**P**	**P**				**P**	
OP4: Conduct target outreach for vertical partners	**P**				**P**	**O**	**L**	**P**	**P**	**P**	**P**	**P**	**P**	**P**
OP5: Define subscriber terms and categories	**O,P**	**O**				**O,P**	**L**						**P**	**P**
OP5: Prepare subscriber recruitment materials	**P**				**P**		**L**						**P**	
OP6: Conduct active, ongoing subscriber recruitment campaign	**L**	**O**		**O**	**P**	**O,P**	**L**	**P**	**P**	**P**	**P**		**P**	
OP7: Promote special project service offerings	**O**	**O**		**O,P**			**L**						**L**	**P**
OP8: Conduct periodic user satisfaction surveys	**P**				**P**	**O**	**L**	**P**	**P**	**P**	**P**	**P**	**P**	**P**
SP: Special Project and Service Delivery														
SP1: Identify special project offerings	**O,L**	**O**	**P**	**P**	**P**	**O,P**	**L**	**P**	**P**				**P**	**P**
SP2 Set-up management structure for new projects	**P**					**O**	**O,P**						**L**	
SP3: Accept new special projects and negotiate terms	**O,P**	**O**				**O**	**L**						**P**	
SP4: Assign manager and team for each special project							**L**						**P**	
SP5: Prepare project plan for each special project	**P**				**P**	**O**	**O,P**						**L**	
SP6: Execute project	**P**				**P**		**O**	**P**	**P**	**P**	**P**	**P**	**L**	**P**
SP7: Monitor and report on project status						**O**	**O,P**						**L**	
SP8: Close out project						**O**	**O,P**						**L**	
OM: Ongoing GC Management														
OM1: On-going staff/personnel management	**O,P**	**O**			**O**	**O**	**L**						**P**	
OM2: Monitor/Manage GC time and finances	**O,P**	**O**			**O**	**O**	**L**						**P**	
OM3: System administration and support	**O,P**				**O**	**O**	**L**						**P**	
OM4: Monitor GC activities and service delivery	**O,P**				**O**	**O**	**L**						**P**	
OM5: Prepare detailed management reports	**O,P**				**O**	**O**	**L**						**P**	
OM6: Manage meetings and communications with Oversight Body	**O,P**					**O**	**L**						**P**	
OM7: Prepare bi-annual status reports	**O,P**	**O**			**O**	**O**	**L**						**P**	
OM8: Schedule and handle logistics for GC meetings and events	**O,P**					**O**	**L**						**P**	
OM8: Periodic review and audit of GC operations	**O,P**	**O**			**L**	**O**	**P**						**P**	

[1] Idaho's Geodetic Control Technical Working Group and Montana's Geodetic Control Workgroup

6.3 Resource Requirements for Development

6.3.1 Overview of Resources

Resources for GC operation include all funding, staff, and tangible commodities necessary for GC operation:

a) Office location and space: including furniture, office supplies, and other amenities).

b) Computer systems and equipment: Servers, desktop or laptop computers, peripheral devices, networks, software, copy machine, projection units, etc. This category also includes hardware and software maintenance and support service contracts.

c) Personnel: Management and administrative support personnel and technical/professional staff.

d) Funding: Monetary contributions and support for GC development and operation

Information gathering conducted for preparation of this *Business Plan* indicates there is a general consensus that the GC requires a physical location and facilities from which GC operations are managed and services are provided. However, there is an acknowledgement that limitations on funding, at least initially, will limit the scope of GC operations and the facilities and staff that can be supported and that the GC will begin with an informal structure and agreements between existing programs (ISU GIS TReC and the Montana State Library). For this reason, three key principles will guide the establishment of the GC and offering of GC services:

- GC development should follow a careful, incremental approach. Put in place high-priority and lower cost services first and gradually add additional resources and services. A general phasing for the GC development is summarized above.
- Establish a strong working relationship and formal agreements between key organizations in Idaho and Montana.
- Full GC development and operations will require resources and staff which are not currently in place. For this reason, a fundamental need is to identify partner organizations (public and private) which can provide funding and non-monetary support for the GC.
- Establish the GC as a program managed by an existing organization rather than creating a new organization. Section 4 explains organizational options and the recommended approach for the GC, which calls for an informal structure to begin followed by a more formal structure and an established GC management office.

6.3.2 Office Space, Computer Hardware, and Office Equipment Requirements

Space and facility requirements will change over time as the GC evolves and expands. It is assumed the GC will use facilities of a host organization—with necessary arrangements for cost reimbursement consistent with the policies of the host organization and terms established for GC hosting. At a minimum, each GC will require the following:

Server(s): Access to a Web Server and, ideally an application and/or database server (behind a firewall) with sufficient database storage space for GIS data, orthoimagery, and database requirements.

Network Access: High Speed network link for external Web-based transactions and local area network access (wired or WiFi) at the GC site(s).

Server Software: Server software license requirements, in addition to operating system, network management, and Web Server software include: a) full Microsoft Office Suite and other document-based software (e.g., Acrobat), b) Web site design and management software c) database Management software (e.g., IBM DB2), d) RTN software.

Desktop Computers: A limited number of high-end desktop computers with sufficient processing speed, memory, graphics processing, and large display screen to handle routine processing tasks.

Peripheral Computer Devices: At a minimum, a page size (letter, legal size) monochrome laser printer or multi-function device (print, scan, fax, copy) should be available. Specific GC services will benefit from access to a large format (E-size) color ink jet plotter and/or a large format scanner.

Meeting Room Facilities: A meeting room with table, chairs, whiteboard and ideally equipped with desktop computer, projection device, and network links for use in group meetings and training sessions. Availability of desktop computers for training would be beneficial.

Office Space: Limited space (cubicles or enclosed offices with desks of table) for GC employees or temporary project workers.

Office Equipment and Supplies: At a minimum, a copy machine (preferably a digital networked copy/printing device) should be available and there should be a source of basic office supplies.

As already mentioned, the degree to which the GC can make use of facility, computer, and equipment resources of an existing organization, the more efficient it will be. It is expected that, as services expand with a growing demand, increased funding will be available for expansion of physical resources.

6.4 Budget Projections

This Section provides high-level budget projections for GC development and operations. These budget projections are organized into the following categories:

- GC Management and Staff: Includes all compensation and associated benefits and overhead for all management personnel and staff occupying full-time or part-time positions, contracted staff, student interns, and other staff resources for GC development and operations.
- Computer Systems and Software: Includes: a) hardware costs for the acquisition, installation, upgrade, and maintenance of computer servers, desktop computers, peripheral devices, etc. dedicated fully or in part to support GC operations, b) packaged software and its installation and configuration, c) vendor maintenance and support fees, and d) fees associated with network services, Internet access fees, etc.
- Consultant Support: Costs for contracted consultants to support GC development work including support in initial organization and creation of the GC, system configuration and application development (e.g. MCPD enhancement, RTN server access), work on special projects, or other activities for which consultants may be required.
- RTN Base Station Set-up and Maintenance: Costs associated with acquisition, set-up, and ongoing maintenance of base stations for which the GC has direct responsibility
- Promotion and Outreach: Includes costs associated with GC promotional and outreach activities including marketing, attendance at meetings and events, and other communications with users, partners, and other stakeholders.
- Furniture and Office Equipment: Includes costs for office furniture and equipment (e.g., copy machines) acquired specifically for GC use or required lease costs for use of furniture and equipment acquired by the host organization or other organization.
- Office Administration: Costs supporting routine operations including fixed costs for utilities and phone service, office supplies, office cleaning and maintenance, meeting expenses, and other costs which must be assumed in whole or in part by the GC.

- MCPD Application Hosting: Hardware, software, and management costs associated with ongoing operations and enhancement of the Multi-state Control Point Database.

- MCPD Database Administration: Includes the day to day management of the database in an Oracle, SQL Server or similar environment and includes common administrative tasks such as compressions and reconcile/posts

Table 9 presents budget projections for each GC Phase and Fiscal Year. The assumption is that Phase 1 begins at the start of Fiscal Year 2013 (July 1, 2012). No specific costs are included for special project work since project opportunities cannot be predicted at this time and the assumption that staff and non-staff resources for special projects will be funded by the project budget (from the project client). It is important to note that sources for most of the funding requirements presented in Table 9 have not been fully identified or put in place. This *Business Plan* includes critical tasks for exploring and securing adequate funding sources for GC development and ongoing operations. Initial GC development and operation will use funding currently allocated through the ISU GIS TreC and Montana State Library (for MCPD operations) but long-term development and operation must rely on new sources of funding which are expected to include: a) User subscription fees, b) funding from Lead and Associate Partners (see Table 7-Category FS), c) Grants, and d) monetary or in-kind contributions and sponsorships.

Table 9: Budget Projections for GC Development and Operation

		PHASE 1	PHASE 2		PHASE 3		
Cost Item	**Description**	FY2013	FY 2014	FY 2015	FY 2016	FY2017	**Total**
A. GRC Management and Staff	Includes the following: a) 0.10 FTE GC manager in FY2013 growing to 0.20 FTE in FY 2014, and 0.25 FTE in FY 2016 and beyond. b) 0.25 FTE RTN Administrator in FYs 2013 and 2014 growing to .50 FTE in FY 2015 and beyond c) 0.20 FTE technical staff person to support MCPD in FY 2013 and 2014 growing to 0.50 FTE in FY 2015 and beyond d) 0.10 FTE office admin support for RTN and MCPD operations in FY 2013 and 2014 growing to 0.15 FTE in FY 2015 and beyond e) 0.25 FTE for control point data QC f) 1.0 FTE student intern	$60,000	$65,000	$100,000	$100,000	$100,000	**$425,000**
B. Computer Systems and Software	Includes the following: a) Maintenance of existing server hardware at the ISU GIS TReC for RTN operations and at the Montana State Library for MCPD operations in FY 2013 b) Server upgrades for MCDP in FYs 2014 and 2016 c) Second server purchase for RTN operations in FY2014 and upgrades in subsequent years d) Ongoing hardware maintenance contracts e) Commercial software licenses acquisition including either Trimbe NetVRS or Leica Spidernet f) Vendor software support g) Other system acquisition and operation costs to support the RTN and MCPD	$200,000	$50,000	$20,000	$25,000	$25,000	**$320,000**
C. Consultant Support	Includes the following: a) web programming of additions/modifications to MCPD b) related software support	$0	$20000	$0	$0	$25,000	**$45,000**
D. RTN Base Station Set-up and Operation	Includes the following costs for RTN base stations (only stations for which the GC is directly responsible): a) Set-up and configuration of 1 base stations in FY 2014 followed by 3 additional stations in subsequent FYs b) On-going maintenance and replacement of stations	$0	$25,000	$75,000	$75,000	$75,000	**$250,000**
E. Promotion and Outreach	Includes the following: a) Preparation of marketing and promotion materials b) Travel and registration costs associated with meetings and participation in events	$10,000	$5,000	$5,000	$5,000	$5,000	**$30,000**
F. Office Equipment	Includes costs for office equipment (e.g., copy machines) acquired specifically for GC use or required lease costs for use of furniture and equipment acquired by the host organization or other organization	$0	$1000	$1500	$0	$0	**$2,500**
G. Office Administration	Costs supporting routine operations including fixed costs for utilities and phone service, office supplies, office cleaning and maintenance, meeting expenses, and other costs which must be assumed in whole or in part by the GRC.	$4,000	$4,000	$4,000	$4,000	$4,000	**$20,000**

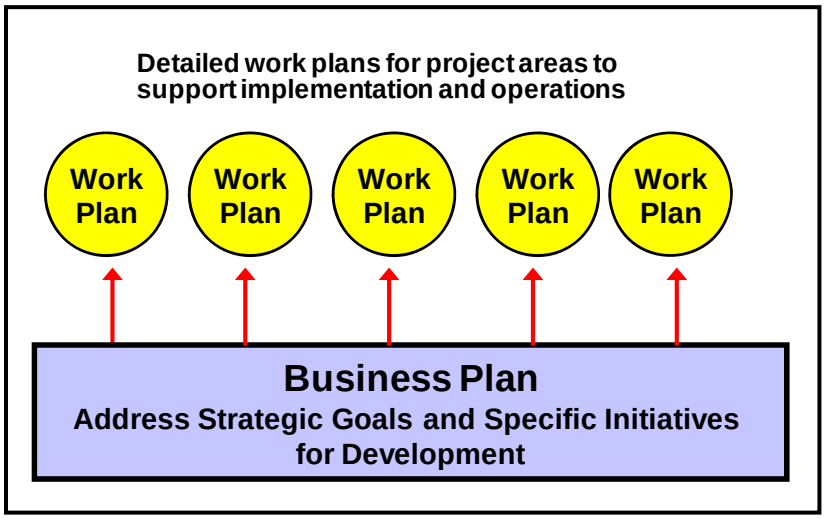
		PHASE 1	PHASE 2		PHASE 3		
Cost Item	**Description**	FY2013	FY 2014	FY 2015	FY 2016	FY2017	**Total**
H. MCPD Application Hosting	MCPD is an Arc Server application therefore must be hosted in a managed Arc Server environment. Funding is provided to support ArcGIS license fees as well as to purchase and maintain tertiary/support software.	$3,000	$3,000	$3,000	$3,000	$3,000	**$15,000**
I. MCPD Database Administration	This includes the day-to-day management of the database in an Oracle, SQL Server, or similar environment and includes common administrative tasks such as compressions and reconcile/posts. Estimated at 0.1 FTE and should remain consistent through FY2017. This is a different task than that described in A (d)	$7,800	$7,800	$7,800	$7,800	$7,800	**$39,000**
TOTAL:		**$284,800**	**$180,800**	**$216,300**	**$219,800**	**$244,800**	**$1,146,500**

7. IMPLEMENTATION MANAGEMENT AND MONITORING

7.1 Relationship between Business Plan and Implementation Work

The success of GC development and operation called for in this *Business Plan* is dependent on an effective management structure, project planning and management, and clearly defined roles. As illustrated in Figure 9, it is critical to maintain the relationship between the GC goals, the tasks in this *Business Plan* and specific work plans that are yet to be developed to put into play specific implementation work.

Figure 9: Relationship between Business Plan and Detailed Work Plans



7.2 Risk Management

Risk management is an accepted practice used in any major implementation initiative, and it should be a part of the work carried out under the implementation initiatives presented in this *Business Plan*. Risk management is a strategy and set of techniques to help prepare for and respond to certain types of changes or events that could negatively affect an implementation. This section provides a general risk management approach that applies, at a high-level, to the overall implementation. Risk management techniques should also be applied at a more detailed level in the Work Plan preparation for specific implementation initiatives and the management of those implementation activities. Risk Management has three main parts: risk identification, risk impact assessment, risk response planning.

7.2.1 Risk Identification

Risks associated with GC development are those conditions or events that could affect work toward GC goals—by delaying work completion, reducing quality, increasing costs, or disrupting organizational coordination of GC participants. Potential risks of main concern for the GC are financial, organizational, and technical. Table 10 explains these risks.

Table 10: Overview of Types of Risks

Risk Type and Explanation	Examples of Specific Risks
Financial Risks Includes risks associated with allocating and sustaining funding and resources for GC implementation work. This includes internal decisions inside the organization that impact funding streams, external economic changes that influence resources available for GC, and potential problems with implementation planning or management resulting in over budget projects.	• Insufficient internal funding allocation or funding diverted to other projects • Expected external funding does not materialize • Dedicated staff resources not sufficient • Cost projections do not meet actual costs • Poor contractor performance results in increased costs
Organizational Risks Includes risks that have their source in organizational, political, or legal aspects of GC development. This includes all aspects of organizational relationships, management, staff assignments, governance structure, high-level legislative and executive support, legal and policy rulings, and all types of political and media influences on GC implementation work.	• Expected legislative support is not provided • Lack of sufficient senior executive awareness and support • Expected level of participation from stakeholder groups is not delivered • Administrative delays in personnel actions and policy approval • Organizational/legal obstacles in forging formal partnerships • Contract discrepancies impact timing and quality of contracted work • Poor management and coordination creates delays and obstacles to consensus • Political battles reduce level of collaboration and joint project participation
Technical Risks Includes risks associated with the technological and operational aspects of the GIS program or project, including hardware and software, network configuration, and database development, security breaches, and the procedural workflows associated with technology acquisition and implementation. These risks reflect potential technical obstacles in system development that could affect costs or the schedule.	• Delays in forging technical standards to be used as basis for development work • Problems with software or hardware installation and configuration, or functionality • Insufficient technical staff and skills for required implementation work • Problems with source materials or techniques used in database development • Network communication performance limitations impact access to data and services

7.2.2 Risk Impact Assessment

Risk impact assessment is a process for assessing the likelihood of a risk event and its impact on the GC implementation. Its purpose is to give managers a way to anticipate risk and assign priority as a basis for taking appropriate action. GC risks, explained in Table 11 above, could influence one or more of the following:

- Monetary cost or resources: impacts on the anticipated (planned or budgeted) monetary cost, staff levels, or other tangible resources for the project or program.
- Schedule/Timing: impacts on the planned schedule and timing for completion of deliverables or milestones
- Work Scope and Services: impacts on the nature, volume, contents, specifications, etc. of the products, services, and results planned for a project or defined for a GIS program
- Quality of Work and Deliverables: impacts on quality of products and services which may relate to accuracy, amount of error, reduced performance, etc.

Risk impact assessment involves assigning a level of likelihood of the occurrence of a potential risk event and a severity level that gives a gauge on how much impact the event could have on cost, schedule, scope, or quality. While in some cases, it is possible to assign numeric measures to risk likelihood and severity, the more realistic

approach for most GC implementation initiatives is to use qualitative scores (e.g., High, Moderate, Low). This usually gives a sufficient indication of risk potential and impact to support risk response planning.

7.2.3 Risk Response Planning

The risk identification and risk analysis described above is the basis for monitoring risk events and taking appropriate action by applying specific risk response practices. The Project Management Institute and other sources define three major risk response strategies:

- Avoidance: Adjusting a project plan (e.g., reducing schedule or scope) or resources (using alternative staff resources or funding sources) when risk events become evident, to avoid the risk or isolate its impacts.
- Transference: Transferring the consequences or responsibility of a risk to a third party. Transference does not eliminate a risk; it only shifts responsibility. The most common strategy for risk transference is through well-designed contracts for certain elements of the work.
- Mitigation: Reduction in the probability and/or consequences of an adverse risk event to an acceptable level. Usually includes project controls for identifying risk events early in a project and taking formal action before impacts are great.

Risk response approaches should be specifically identified as a part of detailed work planning for specific implementation initiatives. At a general level, there are well-accepted project management practices that make use of the three risk response strategies:

- Prepare detailed and realistic work plans that clearly define tasks, deliverables, and schedule and use these plans as a basis for executing and monitoring work.
- Establish effective project status monitoring and quality review procedures for tasks and deliverables. Use this monitoring as a basis to identify possible problems (with scope, schedule, or quality) early in the process so that corrective action can be taken.
- Assign competent and well-trained project management and team members.
- Use contractors effectively (as a risk transference strategy) but ensure that contract specifications, performance requirements, and legal terms are clear to all parties.
- Build sufficient slack time into the project schedule to allow for adjustments to timing should delays occur.
- Investigate and have options for alternate sources of funding and staff resources that can be tapped if committed resources are reduced.
- Get formal commitments (written agreements or project charter) for organizations participating in an implementation initiative.

7.3 Monitoring and Reporting on Progress

GC development should be accompanied by regular tracking and reporting of development status. This includes the tracking of progress against strategic goals and individual implementation initiatives. Procedures for status monitoring and reporting are discussed in this section.

7.3.1 Strategic Goal Monitoring and Reporting

Goal monitoring and reporting is a high-level GC management activity that gives a picture of general progress on GC development. The result will be a "Strategic Plan Progress Report" prepared on a quarterly basis. The

report will be formally prepared for the GC Oversight and Advisory Body but distributed to all project stakeholders (including the management personnel of the Montana State Library and Idaho State University administration). The report summarizes activities relating to each goal with summary remarks about overall progress and critical issues. The report will follow a format like that shown in Exhibit A.

Exhibit A: Suggested Format for GC Quarterly Progress Reports
(Summary reports on progress against goals)

IDAHO-MONTANA GC-BUSINESS PLAN QUARTERLY PROGRESS REPORT

Submitted by: xxxxx

Submitted to: xxxxxx

Submittal date: xx/xx/20xx

Report period: xx/xx/20xx to xx/xx/20xx

Summary of Overall Progress:

Xxxxxx xxxx x xx xxxxx x xxx xx xxxxxxx xxx xxxxxxxxx x xxx xxxx x xxx xx xxxx x xxx xx. Xxxxxx xxxx xxxxxx x xx xxx xxxxxxx xxx xxxxx xxx xxxxx xxxxx xxx x xxx xxx xxxxxxx xxxxxx xx xxxx xxxxxxxxxx x xxx.

Summary of Progress Against Goals:

Goal 1. Establish and maintain a physical facility with the necessary hardware, software, office space, and personnel to support GC services and activities.

- Xxx
- Xxx
- xxx

Goal 2. Develop, deploy, operate and maintain a database and associated Web service for entry of and access to high-quality geodetic control information.

- Xxx
- Xxx
- xxx

I

I [Goals 3 to 7]

I

Goal 8. Establish effective outreach, promotional tools, and activities to encourage and expand the user community and to sustain awareness of and active involvement in GC activities.

- Xxx
- Xxx
- xxx

Important Issues:

Xxx xxxxx xxxx xxxxx xx x xxxxx xxxxxxxxxx xx xxxxxxxxxxx xxx xxx xxxx xxxxxxxxxxx xx xxx x xxx xxxxx xxx. Xxx xxxxxxx xxx xxx xxxxxxx xxxxx xx xxxx xxxxxxxxx x xxx xxxxx xxxxxxxx xx xxxxxx xxx xxx

These quarterly Strategic Plan Progress Reports are completed by the GC Management Team (initially) and by the designated GC Manager when this position is filled. This requires an efficient bottom-up communication process in which information on specific implementation work is reported on a regular basis. The GC Implementation Status Report, discussed below, provides information for completion of these quarterly reports.

7.3.2 Monitoring and Reporting of Status

This is a more detailed reporting, referred to as the "GC Implementation Status Report" that captures summary status information about work being carried out for implementation initiatives in this *Business Plan*. The intended audience for these reports is management personnel directly involved in GC development oversight,

project managers and team members, and other stakeholders who are actively engaged in implementation work. These reports will be prepared on a quarterly basis, or more frequently if desired, using information provided by project teams and individuals assigned responsibility for work under specific implementation initiatives. The format similar to that shown in Exhibit B will be used.

Exhibit B: Suggested Format for Detailed Implementation Status Report

IDAHO-MONTANA GC DETAILED IMPLEMENTATION STATUS REPORT

Submitted by: xxxxx
Submitted to: xxxxxx
Submittal date: xx/xx/20xx
Report period: xx/xx/20xx to xx/xx/20xx

Summary of Progress on Implementation Initiatives: Xxxxx xx xxxxxxxx xx x xxx xxxxxxxxxxx xxxxx xxxxx xxxx x xxxx xxxxx xxxx xxxxxxxxxxx xxx. Xxxxxxx xx xxxxxx xxxxxxxxxxxxx xxx xxxxx xxxxx xxxxxx x xx xxxxx xxxx xx xxx x xx xxx xxxxx xxx xx xx x xxx

IMPLEMENTATION INITIATIVES	Plan Start	Plan Finish	Actual Start	Actual Finish	Percent Complete	Comments
OR: Establishment and Set-up of Organizational and Governance Structure						
OR1: xxxxxxxxx						
ORx: xxxxxxx						
FS: Securing and Sustaining Funding and External Support						
FS1: xxxxxxxx						
FSx: xxxxx						
MC: MCPD Enhancement and Operations						
MC1: xxxxxxxxx						
MCx: xxxxxxxx						
RT: RTN Technical Design, Development, and Operation of Services						
RT1: xxxxxxxxxx						
RTx: xxxxxxxxxxxx						
OP: GC Outreach, Promotion, and External Collaboration						
OP1: xxxxxxx						
OPx: xxxxxxxxxx						
SP: Special Project and Service Delivery						
SP1: xxxxxxx						
SPx: xxxxxxxxxx						
OM: Ongoing GC Management						
OM1: xxxxxx						
OMx: xxxxxxxxxx						

7.3.3 Tools for Monitoring and Reporting

Compiling Bi-annual Status Reports should use software packages that are part of the Microsoft Office suite—including Word, Excel, and Project. The Bi-annual Reports will be prepared as a Microsoft Word document. The GC Implementation Status Report will use a combination of Microsoft Project and Excel. A Microsoft Project file accompanies this *Business Plan*. This file has been created with custom views for tracking and reporting progress. Information from the Project file may be exported to an Excel spreadsheet for creation of reports like that shown in Exhibit B.

7.4 Marketing and Outreach Approach

Continual, sustained communications and outreach activities are critical for accomplishing GC goals. Implementation Initiative FS1 calls for the preparation of a marketing strategy that defines all marketing, outreach, and communication activities. This helps coordinate a variety of promotional, recruitment, and funding activities called for in this *Business Plan*.

The purpose of promotional activities is to increase the awareness and understanding of, support for, and participation in the GC and the services it provides. In essence, a GC promotional campaign mixing education with a certain amount of advertising to connect with stakeholders and generate interest while conveying real information about GC applications and benefits. In addition to promotion of the GC program, there is an ongoing need to keep in contact with the user community, provide technical support, and offer assistance in training and professional development. There are many approaches and communication elements that may comprise a successful promotional campaign including:

- Descriptive Information and Links: Information that describes and explains the GC and its services and products at summary and detailed levels. This includes various text and presentation pieces (brochures, guides, presentation materials) that can be accessed on-line or distributed in hard copy form.
- News and Status: Continuing information about the GC's status and activities, and about GC operations and services.
- User Support: How-to information and specific user technical assistance and help relating to use of GC provided data, services, applications, access to data, etc.
- Project Information and Support: Detailed information about specific projects sponsored or coordinated by the GC and tools supporting coordination and group collaboration for project work.
- Vendor Opportunities: Information about business opportunities for product and service vendors about competitive procurements and project opportunities.

An important part of GC promotion is the concept of "branding"—a marketing term that refers to the creation of an identifiable name and symbol that represents the GIS program. Specifically, it involves the creation of a name or acronym, effective logo, slogan, and similar marketing devices and the use of these in all appropriate venues and channels. The purpose is to capture the attention of people and induce them to find out more—leading to participation and support. Branding may be supported by the creation of a number of explanatory, promotional information items including such things as: a) a brief single or two-page brochure or flyer available in hard copy and accessible via the Web, b) a Web page with easily accessible information about the GC including its mission statement and goals, and c) a more detailed descriptive document about the GC. Also, access to formal documents such as strategic plans, charters, etc. is important. The brand can be further communicated by various promotional strategies such as:

- Affix the logo and slogan to all appropriate materials, Web site, and information delivery channels.
- Create icons that can be used symbolizing specific initiatives or products of the GC, and use these icons for communications and identification.
- Produce and stock some appealing "promotional trinkets" with the GC program logo (e.g., buttons, luggage tags, zipper pulls, compass balls, bookmarks, mouse pads, etc.) and give these away at relevant events. Avoid selecting expensive items but choose ones that will be appealing to the audience and which will likely be used in environments where they would receive additional exposure. Explore the possibility of vendor sponsorships to pay for these items.
- Devise an award/recognition program—perhaps in association with other organizations or bodies in which people or organizations can be formally recognized for accomplishments that contribute to the GC and user community. Conduct award ceremonies in conjunction with special events and use other communication channels to promote the awards programs and the recipients.

- Use multiple communication channels for distribution of information about "people and applications." This could include brief articles that highlight GIS applications of interest, as well as "profiles" of GIS professionals on staff and among the user community.

Successful communication with the GC user community is dependent on selecting and using effective "channels" and delivery mechanisms. Take all opportunities to conduct briefings and education programs to local and regional groups and events. Some effective channels and mechanisms that can be valuable for GC outreach and promotion include:

- Presentations and Briefings at Organization Meetings
- Presentations at GIS and Professional Events
- Training and Education Sessions
- Content Search Tools and Applications
- Web Page, Web Portal Delivery
- Email Broadcast or Push
- Publications
- Sponsorship of or Participation in Special Events
- Press/Media Releases
- Exposure via Professional and Business Associations
- User Help Tools
- Collaboration Tools for Project Teams

APPENDIX A: RESULTS OF SURVEY

3. Do you currently collect survey, mapping, or geodetic control data?		
Answer Options	**Response Percent**	**Response Count**
Yes	88.7%	94
No	11.3%	12
answered question		106
skipped question		0

4. Do you currently use or plan to use survey, mapping, or geodetic control data in the future?		
Answer Options	**Response Percent**	**Response Count**
I currently use these types of data	88.7%	94
I plan to use these types of data	8.5%	9
I do not use or plan to use these types of data	2.8%	3
Please explain the status of your use (optional)		27
answered question		106
skipped question		0

5. For what purposes do you use or plan to use surveying, mapping, or geodetic control data?		
Answer Options	**Response Percent**	**Response Count**
engineering design	46.4%	45
land surveying	61.9%	60
parcel mapping	57.7%	56
infrastructure location and inventory	50.5%	49
support for digital map registration or aerial data capture	41.2%	40
vehicle navigation	10.3%	10
support for precision farming	7.2%	7
Research	17.5%	17
Describe in additional detail as needed		10
answered question		97
skipped question		9

6. Describe current limitations or obstacles related to your use or access to survey, mapping, or geodetic control data.		
Answer Options	**Response Percent**	**Response Count**
Insufficient control data for my area of interest	44.3%	43
Insufficient metadata	22.7%	22
Unacceptable accuracy	26.8%	26
Difficulty in finding control data	40.2%	39
Information is not easily accessible/requires trips or inquires to several organizations (e.g. counties,	35.1%	34

USFS, etc.)		
Other	22.7%	22
Please provide additional detail as needed		22
	answered question	97
	skipped question	9

7. Please rate the following on a scale of 1-5 (5 being highest)

	not important at all 1	2	3	4	critically important 5	N/A	Rating Average	Response Count
Characterize the importance or priority of survey, mapping, or geodetic control data for your organization.	0	3	9	30	54	1	4.41	97
						answered question		97
						skipped question		9

8. What is your current source of survey, mapping, or geodetic control data?

Answer Options	Response Percent	Response Count
Montana Control Point Database	7.2%	7
GCDB	41.2%	40
NGS	48.5%	47
USGS	33.0%	32
BLM	41.2%	40
USFS	16.5%	16
County	46.4%	45
City	36.1%	35
NAIP or other aerial imagery	42.3%	41
Other existing GIS data (please specify below)	10.3%	10
Survey-grade GPS	64.9%	63
Resource-grade GPS	35.1%	34
Other	12.4%	12
Not currently using any control data	3.1%	3
Please provide websites or service descriptions		12
	answered question	97
	skipped question	9

9. How do you currently correct GNSS (GPS) data?

Answer Options	Response Percent	Response Count
I/my organization does not correct GPS data	14.1%	13
WAAS	14.1%	13
Post-processing with local base stations	44.6%	41
Post-process with OPUS	50.0%	46
Real-time correction using my own base station	40.2%	37
Real-time correction using a transmitting CORS-type	26.1%	24

base station		
Real-time network (RTN) correction	9.8%	9
Other (please specify)	7.6%	7
	answered question	92
	skipped question	14

10. Please rate the following on a scale of 1-5 (5 being highest)

Answer Options	not important 1	2	3	4	Critically important 5	N/A	Rating Average	Response Count
How important is access to real-time position corrections?	3	9	18	28	30	4	3.83	92
						answered question		92
						skipped question		14

11. What level of positional (horizontal) accuracy do you require?

Answer Options	Response Percent	Response Count
10 meters (~30 feet)	2.2%	2
5 meters (~15 feet)	1.1%	1
1 meter (~3 feet)	16.3%	15
0.15 meter (~6 inches)	9.8%	9
0.025 meter (~1 inch)	14.1%	13
0.010 meter (< 0.5 inch)	39.1%	36
Various/undefined	12.0%	11
Other (please specify)	5.4%	5
answered question		92
skipped question		14