

Federal Geographic Data Committee - National Spatial Data Infrastructure
2004 Cooperative Agreements Program - Announcement Number 04HQPA0006
Category 5: Establishing Framework Data Services using the
OpenGIS Web Feature Service

Wisconsin Consolidated Geodetic Control OGC-WFS Service Project

Proposal Summary:

- a. **Applicant Organization:** WI State Cartographer's Office
- b. **Collaborating Organizations:** USGS, NGS, WI DOT, Dodge County Land Information Office
- c. **Organization Internet address:** <http://sco.wisc.edu/>
- d. **Identity of Registered Clearinghouse metadata collection:** <http://wiselinc.state.wi.us/>
- e. **Key project Contact:** Ted Koch, State Cartographer, (Ph.) 608/262-6852, (f) 608/262-5205, tkoch@wisc.edu
- f. **Other contact personnel:** AJ Wortley, (Ph.) 608/265-8106, (f) 608/262-5205, lwortley@wisc.edu
- g. **Geographic scope or area:** Wisconsin
- h. **Framework themes:** Geodetic Control

(1) Project Application:

Wisconsin geodetic control information delivery through an OGC-WFS service will provide a coordinated comprehensive interoperable view and access mechanism, and establishing an institutional model for delivering framework data web services from distributed source agencies.

Our goal in applying the Open GIS Consortium (OGC) Web Feature Specification (WFS) 1.0.0 to Wisconsin geodetic control is both technical and institutional in nature. The State Cartographer's Office (SCO) has long recognized the foundational value of geodetic control for positioning and mapping of geographic data. The Office has a long and extensive history (since 1975) of researching, storing, and providing geodetic control information for the state of Wisconsin. Currently, the public may access control information through Version 2 of our web-based *ControlFinder* application: <http://sco.wisc.edu/geocat/>. The next step in distributing this information to the widest possible audience is to publish this geodetic control information as an INCITS-L1 standards-based service in the Open Web Services (OWS) architecture. This will enable a comprehensive view and access point to Wisconsin geodetic control information from distributed source agencies through a single portal-like service.

Wisconsin geodetic control information is maintained at the federal, state, and local levels. Currently the SCO provides online access to NGS control, historical USGS 3rd Order Vertical control (minimally maintained by the SCO), Wisconsin Department of Transportation (WI DOT) Height Modernization Program (WI-HMP) control, and control established by Wisconsin counties through High Accuracy Reference Network (HARN) densification supported by Wisconsin Land Information Program (WLIP) funding. Currently, we update control 'layers' independently with each agency according to their publishing schedule and ability to provide updated information. We provide graphical mapped access to these layers of control through our web-based *ControlFinder* application.

ControlFinder is a MapServer (an Open Source software for building spatially enabled Internet applications - <http://mapserver.gis.umn.edu>) based dynamic mapping application providing a visual map query interface to geodetic control from multiple agencies. In *ControlFinder*, geodetic control is

projected into a common view and users can visually navigate to, locate, and query control points. Point records may be saved to a “Results” set and exported for use in other software. When available, point records are also linked to source-agency metadata or related information (e.g., links to FGDC metadata, NGS points link to NGS datasheets on the NGS website; some local control points linked to scanned tie-sheets on a county website.) Currently, updating point information is still very much a manual process, ranging from download of NGS information from the NGS website to solicitation of Excel-based control records from county surveyors.

In *ControlFinder*, we store point locations and minimal point metadata in ESRI Shapefiles served through MapServer and connected to point records and collection-level metadata in a MySQL database. This approach is conducive to our ability to “map” collected information to database fields for query and report. Our intent from the initial creation of *ControlFinder* (2001) has been to model the database storage of point information to match the emerging FGDC/FGCS Geodetic Control Data Content Standard and eventually store the collection directly in a geodatabase, or spatially-enabled database. Under the newer Geospatial One-Stop (GOS) initiative, the geodetic control content standard’s release process has been jump-started and a ‘Version 1’ of this Content Standard is now available from the GOS website. Our other intent in using MapServer for this application is, in the long-term, to facilitate more automated update of our index of statewide control information by encouraging agencies to make their control accessible (to *ControlFinder*) through map services, specifically, point feature services encoded in GML format. The technology to do this is recent and the visible working models are few.

Ultimately, our delivery of Wisconsin geodetic control information will provide a technical model for setting-up and serving an OGC/WFS-compliant service delivery framework for feature data encoded in Geographic Markup Language 2.0 (GML). In addition, we are facilitating an institutional model for maintenance and update of a framework theme over a statewide extent originating from multiple agency sources. Through our continued interaction and long-term relationships with those source agencies, we will eventually create a state network of WFS geodetic control services that feed county applications, statewide applications (like *ControlFinder* and WISCLINC), and federal applications (like *The National Map*). This, to us, is true distributed interoperable mapping information delivery for the benefit of all.

Approach and Implementation

Use of CAP funds will go toward the facilitation and construction of a comprehensive Wisconsin-oriented OGC-WFS service accessible from any WFS-capable client including ArcGIS and other desktop clients, *The National Map*, Wisconsin Land Information Clearinghouse (WISCLINC - Wisconsin’s NSDI Clearinghouse node) and its emerging Open Web services viewer, the Geospatial One-Stop portal (as harvested metadata), and other online applications requiring Wisconsin control information. The project will have a technical phase and an institutional phase running simultaneously.

For the technical phase, we will hire a graduate student Project Assistant to work with AJ Wortley, the project manager. This team will extend an existing MapServer application template to be a WFS server; and then prototype encoding of the *Geographic Information Framework - Data Content Standards for Geodetic Control* in GML 2.0 to be served through this server interface. This approach will be well-documented; and in the second half of the project we will solicit state or local agency support in also launching a WFS service to demonstrate a proof of concept model for pass-through of local services as a “funneled” statewide standards-based service of framework data. This statewide service will be the viewable data source for our own *ControlFinder* application and *The National Map*, at a minimum.

On the institutional side, we will hire a second graduate student Project Assistant to support Brenda Hemstead, IS Resources Support Specialist for the SCO, in continuing to solidify and complete the

network of data providers contributing geodetic control to the application. This team will automate to the extent possible current contribution methods and series/agency-level metadata. Based on our experience, we will continue to make recommendations to a slower-moving statewide Enterprise GIS initiative on requirements for networking of data providers and their metadata for critical framework data themes supporting framework initiatives such as *The National Map*, Geospatial One-Stop, the Wisconsin Land Information System etc.

(2) NSDI/GOS Related Experience:

The SCO has extensive experience in metadata training, FGDC CSDGM metadata verification and editing, NSDI Clearinghouse, framework, and standards development, and online information delivery as well as a long history of statewide outreach and coordination efforts with local, regional, tribal, state, and federal GI entities. Within the past 6 years, the SCO:

- Continues working on a current FGDC-CAP 2003 grant, Wisconsin Open Geospatial Web Services project, during which (and combined with other work) we are performing a mass update on the Wisconsin FGDC metadata repository and re-launching the Z39.50 service (from our own server). We are also providing linkages to OGC-WMS or ArcIMS services which will be viewable through our own OGC-compliant web services viewer as well as other state applications, *The National Map* viewer (via GOS portal), and of course, the source agency webmapping site. This overall effort will result in a new WiscMAP site, which will incorporate the functionality of WISCLINC into a broader cataloging and registry effort of agency metadata, FGDC dataset-level metadata, and OGC service-level metadata.
- Provided metadata training throughout the state through at least 4 different initiatives resulting in 14 workshops reaching at least 175 professionals over the last 6 years:
 - < 1 FGDC-National Park Service (NPS) supported Great Lakes Network Geospatial Metadata Development Workshop (2-day) for regional NPS and tribal GIS personnel. (NPS Great Lakes Monitoring Network CAP 2003 sub-contract)
 - < 1 UW-Madison campus, SCO metadata development workshop (March, '03)
 - < 8 regionally-located workshops under FGDC-CAP 2001 Metadata Trainer grant (10/01-8/02)
 - < 4 regional workshops under FGDC-CAP 1999 Metadata Workshop grant (10/99-7/00)
- Prototyped an on-line dynamic map orthophotography catalog providing a spatial exploration interface through which to navigate and query (through metadata tied to footprints) the availability of orthophotography over an area in Wisconsin (FGDC-CAP 2001 Framework grant). This project resulted in our current operational application, *OrthoFinder* (<http://sco.wisc.edu/orthocat/>.)
- Produced an on-line webmapping/query application, *ControlFinder*, based on the *OrthoFinder* model, through which one can navigate, view, query, and save a custom collection of geodetic control point descriptions from within a webmapping display integrating NGS, legacy-USGS 3rd Order vertical, and locally maintained geodetic control. (released April, 2003; Version 2 released June, 2004)
- Assumed custodian responsibilities for update, expansion, and maintenance of WISCLINC, Wisconsin's NSDI Clearinghouse node, through internal staff contributions and a contract with the Wisconsin Land Information Board (WLIB). Over the last 7 years, *WISCLINC*:
 - < was first created and minimally populated under a 1994 FGDC grant;

- < was expanded and enhanced under contract with WI Department of Administration /WLIB (5/99-11/00)
 - < grew as a metadata repository from 53 to 364 metadata records;
 - < doubled in number of contributing agencies;
 - < expanded through a new website design to provide increased access to metadata and clearinghouse functionality and support resources;
 - < provided extensive metadata training resources; (- 2002) and
 - < will now be re-cast on an SCO server as Z39.50 XML metadata repository as part of a larger *WiscMAP* site encompassing metadata, agency, and service registries (FGDC CAP 2003 Web Mapping Services/Clearinghouse grant - ends August, 2004) and eventually, OGC Catalog Services.
- Participated on various State standards efforts and task forces including the WLIA Wisconsin County Coordinate System Task Force, Wisconsin Land Information Board Standards Committee, WLIA Metadata Task Force, to name a few.
 - Provided “help-desk” style support for Wisconsin agencies embarking upon metadata creation for the first time or looking to improve their process for incorporating this aspect of spatial data creation and maintenance into their workflow. Support has been provided via e-mail, phone, and on-site outreach visits and has covered such topics as tool/utility selection and use, strategies for beginning metadata implementation, and particular aspects of the FGDC Content Standard for Digital Geospatial Metadata.
 - Given many presentations to a variety of audiences regarding metadata, clearinghouse, emerging standards, data integration and interoperability and Wisconsin framework efforts. Recent presentations include: ‘The Evolution of National Data Sharing’ (Wisconsin perspective) and ‘Streaming Web Services to your Desktop.’

(3) Installed GIS and Data Service Capability

Our webmapping interfaces and map services are built on MapServer technology, which is regularly updated on our servers to incorporate latest features. MapServer 4.0, our current version, supports OGC-compliant WMS 1.1.0 and WFS 1.0.0 server and client specifications. We log a few thousand requests per month for our two online webmapping applications: *ControlFinder* and *OrthoFinder*. This customer base is tallied independent of visitors to our main educational website and NSDI Clearinghouse node efforts. We do not serve extremely large volumes of data as we act more as a catalog and service provider, maintaining indices and providing access to FGDC metadata records, tabular records, and graphical mapped views of Wisconsin geospatial data, statewide orthophotography, statewide geodetic control, and aerial photography. The proposed service will be established on existing hardware and software infrastructure.

(4) Software Development Partner

The SCO, under guidance of Lee (AJ) Wortley, Outreach Specialist for the Office, will be the project software integrator and development partner. AJ has worked at the SCO for more than 6 years. He has a B.S. in Civil Engineering from UW-Madison. During this time, he has worked on and managed a variety of internal and cooperative projects, many of which are detailed above. These involve web resources, website and application development, and supporting server configurations. AJ has experience in building webmapping servers on which installation of Linux, Apache, MySQL, PHP, and MapServer

represent most relevant software, including the current server configuration on which the SCO webmapping applications, *ControlFinder* and *OrthoFinder*, are run. He currently provides outreach support and workshops related to metadata, standards, and geospatial technologies; manages a student team supporting the SCO, SIAC, and WISCLINC websites; as well as providing a technical liaison between the SCO and UW-Madison Geography Department systems and technical infrastructure.

AJ will spend fifteen percent of his time managing and working on this project including supervision of project staff; management of hardware, software, work plan and workflow; and guidance in encoding the latest geodetic control content standard in GML 2.0 to establish OGC Web Feature Service capabilities.

Brenda Hemstead will spend fifteen percent of her time on this project including direct communication and networking with local and state agency data providers throughout the state; facilitation and documentation of multiple and progressing update methods for agency data; and quality control and series-/agency-level metadata on data sources and local data models.

The two graduate student Project Assistants will work cooperatively with AJ and Brenda in developing the WFS Server, implementing the latest INCITS-L1 Content Standard in GML through the WFS Server, documenting the data and process model for WFS service provision and looking at methods for mapping of non-standards based data contributions to a standards-based data store for incorporation into a statewide framework data service.

(5) GIS Infrastructure Support

This project supports local, regional, and state GIS infrastructure in that geodetic control is a foundational component of all surveying, mapping, and GIS data collection and maintenance. Geodetic control established by NGS, WI-DOT and local governments are crucial components of the geodetic control network in this state. In the context of an anticipated Wisconsin Land Information System (WLIS), our project offers foundational content on three fronts: framework content delivery (geodetic control), technical web services framework example (first WI OGC-WFS service), and an institutional framework model for coordination and pass-through distribution of statewide framework data services in federally-endorsed standard formats.

A.J. Wortley's work continues to build on the reputation of the State Cartographer's Office for clearinghouse coordination and metadata education over the last six years. This solid background and participation by the SCO continues to be a vital contribution as Wisconsin embarks on a multi-year effort for creation of a statewide Wisconsin Land Information System built on well-documented spatial data resources. Funding support through the FGDC 2004 CAP program will further build the existing GIS/LIS infrastructure of Wisconsin, and provide useful evidence and knowledge to people in other states, by:

- facilitating 'best practice' example of serving GML-based WFS services for a Wisconsin framework data theme, and making the data accessible and re-usable through multiple interfaces;
- accelerating the learning process for provision of OGC standards-based web feature services by local governments, and as extension of initial provision of proprietary webmapping sites and services.
- demonstrating collection and integration of heterogeneous service-based and non-service-based framework data for provision through a single standards-compliant statewide open WFS access point; and,
- providing an institutional model for developing statewide networks of data source cooperators, and providing education through those networks to move the community toward delivery of

framework geospatial data services based on current content and delivery standards.