



**Bay Area Regional
GIS Council**



Bay Area Regional Homeland Security Data Server (BAR-HSDS) Critical Infrastructure Protection Initiative (CIPI 3)

*A Joint Proposal by
the Bay Area Regional GIS Council (BAR-GC)
and the Open GIS Consortium (OGC)*

August 20, 2003

Executive Summary

Historically when large-scale disasters occur in California, the primary issue for emergency managers and first responders is not access to hardware, software or geographic information systems (GIS) trained personnel; it is access to critical data and accurate digital information. Since the Northridge earthquake, a number of GIS professionals throughout California have been working toward mitigating this issue with data sharing programs, standards development, and the creation of Regional GIS Councils.

The Bay Area Regional GIS Council (BAR-GC) has been working for the past year on a project plan and design to implement a *Bay Area Regional Homeland Security Data Server (BAR-HSDS) Program* in coordination with local, state, and federal agencies.

With the current emphasis on critical infrastructure and regional asset management, the BAR-GC and the Open GIS Consortium feel the time is right to expand this project into a working prototype for the nation.

This system of data servers will enable sharing of critical infrastructure, key asset data and information across governmental jurisdictions. The system will include incident reporting via the Homeland Security Departments Disaster Management Interoperability System (DMIS) and OGC compliant integration to standard modeling/mapping applications such as Cameo and Marplot.

This system will complement national, state and local first responder and homeland security initiatives.

The goal is to design, develop, and demonstrate an operational prototype for the San Francisco Bay Area that is redundant yet affordable, easy to use, and secure.

The BAR-HSDS will help organizations publish, discover, access, exchange, and maintain the vital geospatial information required to support critical infrastructure protection, response, and recovery operations.



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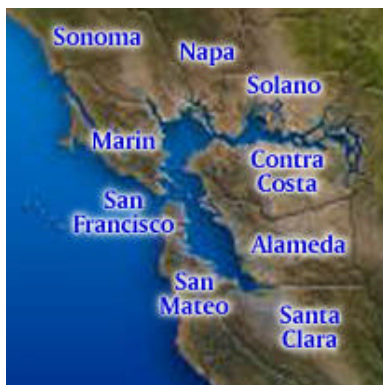


Introduction and Overview

Critical infrastructure, key assets, and supporting data are essential to providing public safety and justice officials with information and analysis capabilities to plan, mitigate, prevent, and respond to critical incidents and acts of terrorism. These data must be gathered from multiple sources in multiple formats, often are not interoperable between systems, and frequently are not shared within or among agencies. Also lacking are metadata (i.e. data documentation) the appropriate blend of centralized, distributed and redundant systems for operational use, and contingency backup-recovery systems and procedures for critical technical and operational purposes.

A proposal to address these issues in the San Francisco Bay Area is hereby submitted by the Bay Area Regional GIS Council (BAR-GC) and supported by the Open GIS Consortium (OGC). The official project sponsor is Contra Costa County, California.

The project we envision will enable sharing of critical infrastructure, key asset data, supporting response data layers and information across governmental jurisdictions through a Bay Area Regional Homeland Security Data Server, the BAR-HSDS. This system will complement national and local homeland security and first responder initiatives. The goal is to design, develop, and demonstrate an operational prototype for the San Francisco Bay Area. The pilot system will facilitate critical infrastructure and key asset data information sharing, analysis, and high-level incident reporting in a heterogeneous environment. The desire is to build a regional system that is affordable, easy to use, and secure. The BAR-HSDS will help disaster and emergency managers and responders to discover, access, exchange, and maintain vital geospatial data required to support critical infrastructure protection, response, and recovery operations.



The BAR-GC is a regional GIS coordination and data sharing organization comprised of municipal, county, regional state and federal government representatives with jurisdiction in the nine-county San Francisco Bay Area – an area over 7,000 square miles with a population of more than 6 million people. The BAR-GC, a consensus organization, also includes non-profit, utility, educational and private sector GIS professionals. It is chartered to “Function as a regional body for the San Francisco Bay Area, to review the California GIS Council’s reports, provide recommendations on policy alignment with local and regional needs, and be a focal point for partnerships to build California’s geographic information infrastructure.”

The BAR-GC will provide overall project leadership and management. This will include contracting a person(s) or consulting firm(s) with extensive project management skills, systems integration expertise and other appropriate experience. OGC with their national view will provide oversight, advice, and other assistance for standards and reference to other agencies that can provide additional appropriate expertise.



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The Chair of the BAR-GC, Elizabeth Klute, is the BAR-GC representative from BAAMA, the Bay Area Automated Mapping Association. BAAMA, a chapter of the Urban & Regional Information Systems Association (URISA), is a professional organization for GIS professionals. Ms. Klute's professional position is the County Community Warning System Manager for the Contra Costa County Office of the Sheriff. She will act as Project Lead for the BAR-HSDS.

The other contributing organization in this proposal is the Open GIS Consortium (OGC), an international industry consortium of over 250 companies, government agencies, and universities participating in a consensus process to develop and establish common interfaces for geospatial information and services. Through the use of open interfaces developed by OGC members, for geospatial information and application services operating on different computing platforms, geospatial information can be rapidly mobilized and applied to critical infrastructure related operations through a standards-based, cross-jurisdictional spatial data infrastructure.

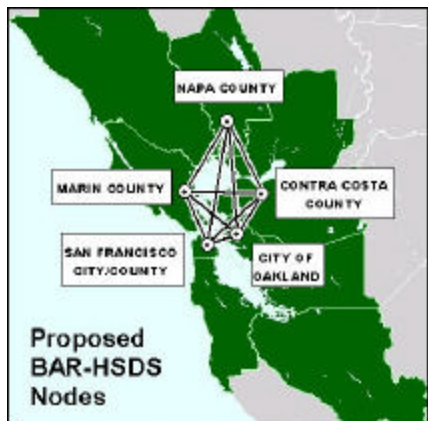
Jeff Harrison, Executive Director Program Development, Open GIS Consortium (OGC) will act as the primary point of contact for the OGC.

Contra Costa County, located in the northeast corner of the bay area region, has an extensive countywide GIS program. Contra Costa also is the home to the largest density of petrochemical plants in the country next to Harris County, Texas. It is the home of Chevron-Texaco World Headquarters, the West Coast US Naval Weapons Station ammunition loading port, and the corridor for nuclear spent fuel rod transportation. Due to their interest in the BAR-HSDS project and their unique risk of natural, WMD, and terrorism incidents, Contra Costa County would like to be the official sponsor of the BAR-GC HSDS project. John Huie, Geographic Information Officer, will act as contractual and financial lead for Contra Costa County.

Background

Bay Area Regional Homeland Security Data Server (BAR-HSDS)

In August 2002, shortly after the BAR-GC was formed, one of its first actions was to identify key GIS projects to serve the region. The project, which received the greatest amount of support from BAR-GC constituents, was a Homeland Security Data Server (HSDS). The goals of this project include sharing information so that all Response, Recovery, and Management organizations have access to a defined set of data, supporting vulnerability assessments of critical infrastructure, and supporting the efforts of public safety agencies to respond to and recover from major natural or manmade disasters.



The focus of this effort is to provide a mechanism for storing and distributing geospatial data with accompanying metadata to those who need it most in an emergency, but not to impose file formats, naming conventions, data projections, etc. upon data providers. Data on the server will be maintained in the format in which it is provided. The plan is to provide each server with a full set of data for all nine counties and other contributing jurisdictions. Redundancy will be achieved by implementing multiple servers in geographically dispersed areas. The project as initially conceived will provide a capability for secure, full-file download via text-based file



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transfer protocol (FTP). These servers will only house data layers of use in emergency operations.

As of this writing, the project is proceeding on schedule. A list of key data layers has been identified for inclusion on the servers. These data layer definitions have been coordinated with the Department of Homeland Security (DHS) Critical Data Requirements document. Data access policies will be managed via a Memorandum of Understanding (MOU) among BAR-GC member agencies – a separate BAR-GC subcommittee is developing this MOU..

OGC Critical Infrastructure Protection Initiatives

Over the past two years, the OGC has engaged in a number of Critical Infrastructure Protection Initiatives (CIPI), a program that helps organizations publish, discover, access, exchange, and maintain vital geospatial information and online geoprocessing services required to support critical infrastructure planning, protection, response, and recovery operations. The architecture developed through these initiatives features a "plug and play" capability enabled by a range of vendor software products that implement OpenGIS® specifications over the Web. The CIPI series of projects provide opportunities for vendors, users, and other interested parties to mutually shape needed services, interfaces and protocols needed for critical infrastructure related operations in the context of a hands-on engineering experience. Industry sponsors join government sponsors in support of CIPI. Systems demonstrated to date offer a range of capabilities for users to quickly render one or more layers of digital geospatial data into map-like products for visualization, analysis and decision-making

For the next phase of the CIPI work (CIPI-3), OGC is seeking to build upon these successes, by partnering with state and regional organizations in an array of multiple, coordinated initiatives that exercise, refine, and demonstrate this architecture in an increasingly operational set of deployments. In addition to perfecting the broad applicability of this approach and building upon the infrastructure already present or under development in these collaborating communities, CIPI-3 deployments will serve as an example to municipalities, regions, and states throughout the nation. This project will assist OGC's meet it's primary mission - *"to deliver spatial interface specifications that are openly available for global use"*.

Technical Objectives

The proposed project includes development of a Geospatial Interoperability Framework (GIF), which provides a technology framework for geospatial based critical infrastructure, key asset, and incident information sharing, based upon OGC, W3C, national and international standards and specifications. Among the requirements for this framework are that it operate in a distributed, heterogeneous environment, and that it ensures data and system security and integrity protection.

Building, testing, and demonstrating the BAR-HSDS is the heart of the project. This prototype system will support accumulation, management, monitoring, and sharing information between authenticated first responder and emergency management organizations. They will have access to critical infrastructure, key assets, and geospatial information at the regional level, through common access to distributed databases at all levels. It will also enable pull-based replication of critical infrastructure, key assets, and geospatial information from remote nodes (state agencies, local agencies, and private institutions) for data centralization and backup-recovery purposes.



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This will also facilitate supporting state and federal reporting requirements for incidents through interoperability with the Disaster Management Interoperability Services (DMIS). The system will also incorporate framework GIS data layers that provide general context for operations, and an application that supports distributed, location-based incident reporting.

Another objective of this project is to test the BAR-HSDS initiative in a live terrorism-based exercise in the Bay Area. This will be held in conjunction with an established exercise program, such as the statewide hospital drill or a national terrorism exercise, and coordinated with organizations such as the Golden Gate Safety Network (GGSN) and the Contra Costa County Sheriffs Mobile Field Force.

Project Planning Overview

The BAR-GC and OGC, propose that the OGC Interoperability Initiative Process Framework be used to develop and execute this pilot initiative. The Process Framework has been used and improved over the course of numerous OGC Interoperability Initiatives sponsored by organizations like NASA, NIMA, USGS, FEMA, Bureau of Census, Natural Resources Canada, Lockheed-Martin, BAE Systems, and others. The framework outlines a series of tasks executed with a virtual team, composed of the organizations and people involved in the project, along with the tools used for communication, organization, and management.

Coordination: This task enables overall Initiative coordination between the BAR-GC project staff, OGC Interoperability Program (IP) Team, Sponsors, Participants (technical implementers), and other BAR-GC, OGC, and contractors as required.

Assessment and Analysis: This task analyzes and documents the existing capabilities of the user organizations and assesses requirements for OGC-compliant technology.

Architecture Development: This task defines the architectural views for the Initiative, in the context of Open GIS Interoperability. Part of the Architecture Development task will be the use of a Request for Quotation (RFQ) and Call for Participation (CFP) to industry to enable organizations interested in participating in this Interoperability Initiative to respond with a proposal. Other tasks vital to the successful execution of this Initiative include:

- Initiative Preparation (e.g., budget definitions and contracting)
- Component Development (engineering)
- Testing and Integration
- Implementation
- Demonstration and Exercise
- Documentation
- Solution Transfer

What follows is a more detailed scope of work for the Bay Area Regional Homeland Security Data Server (BAR-HSDS) and Incident Reporting project.



Project Approach

Introduction

The Bay Area Regional GIS Council (BAR-GC) and the OGC propose a regional homeland security project that will produce the initial operating capability of a Bay Area Regional Homeland Security Data Server (BAR-HSDS) and an incident reporting environment. The system will apply appropriate geospatial data and technology resources, including state and federal resources, to regional emergency response and incident management. A key focus of this effort is to implement the *Geospatial Interoperability Framework (GIF)* consisting of the data/information and service standards that are required to implement a distributed, cross-organizational homeland security capability. The project team will fully leverage existing geospatial resources, which includes the means to collect, store, and manage critical geospatial data across the region, using existing multi-vendor assets.

Standards-Based Focus

The *Geospatial Interoperability Framework* will be based upon FGDC standards (e.g., National Map), OGC specifications, and other appropriate industry standards. This framework will support geospatial data/information and service resource sharing across the distributed network of contributing Bay Area, State and Federal GIS nodes.

Regional Focus

Many emergencies have a regional context that involves many jurisdictions. Effective response mandates seamless interoperability between all participants. This project will demonstrate geospatial interoperability involving regional assets, supported by the BAR-GC.

Operational Focus

An emphasis of this project is to test and demonstrate the *Geospatial Interoperability Framework* and distributed geospatial resources in a real-world operational context. Following the development of the BAR-HSDS, an existing and new emergency reporting and management application, the Disaster Management Interoperability System (DMIS), will be integrated to access the BAR-HSDS through the GIF. As a third phase of the Pilot, the system will test and demonstrate this capability in a regional exercise.

Project Scope

This purpose of this project is to test and demonstrate an interoperable, initial operating capability for the BAR-HSDS that fully leverages regional geospatial resources in support of emergency response, incident management and reporting. This project has the following objectives:

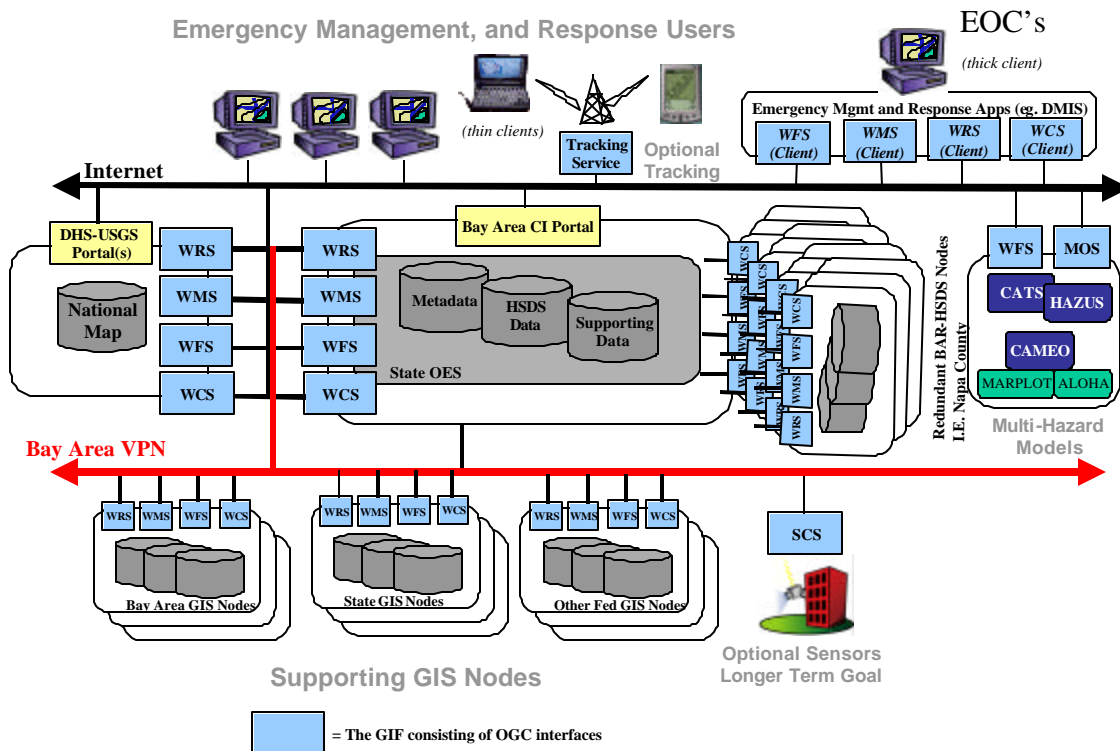
- 1) Define and implement Critical Infrastructure and Key Asset Layers for the Bay Area.
- 2) Define and implement Emergency Operational Support Layers for the Bay Area.
- 3) Design and implement the *GIF* required to support secure access and sharing of applicable geospatial resources.



- 4) Integrated through the *GIF*, the new DMIS emergency incident reporting and specific needs request application, fully leveraging regional geospatial assets.
- 5) Demonstrate these capabilities in an operational, regional context.
- 6) The resulting capability will provide an initial operating capability for the Bay Area, to be subsequently used in field trials and undergo continuing enhancement.

Initial Architecture Concept

BAR-HSDS Architecture Concept



This initial architecture conveys the distributed, interoperable nature of the BAR-HSDS, featuring GIF. Acronyms used in this diagram and key features of this architecture are described below.

GIF – The *Geospatial Interoperability Framework (GIF)* provides secure access to shared regional assets, based upon OGC interfaces.

Bay Area Regional Homeland Security Data Server Portal – This is a secure, critical node with multi-node backup and 24/7 capability that would contain all Critical Infrastructure & Key Asset metadata for the Bay Area. Plus, it would contain Emergency



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Planning and Operational Support Layers. Although illustrated here with a central BAR-HSDS Node for the data, this server will be a distributed, redundant capability, and will be further defined based on regional operational requirements.

DHS-USGS Portals – This is a national-level capability in support of national emergencies and includes the National Map.

Bay Area GIS Nodes – These are the various Bay Area GIS capabilities for collecting, storing, and managing detailed geospatial data across the region, using existing multi-vendor assets. These “Producer” nodes would always contain the latest, authoritative data for their applicable domains. Although some of this data will be replicated at the BAR-HSDS Node, it is suggested that remote nodes also provide 24/7 assured access to authorized users, with backup capabilities.

State GIS Nodes – These are the various State GIS capabilities for collecting, storing, and managing relevant geospatial data for the region, using existing multi-vendor assets.

Federal GIS Nodes – These are the various other National GIS capabilities for collecting, storing, and managing relevant geospatial data for the region, using existing multi-vendor assets.

Project EOC – An EOC capability that operates at one or more sites within the Bay Area, and that hosts one or more emergency response, recovery, reporting, assessment and incident management applications including the DMIS. Contra Costa County (CCC) EOC currently meets this criteria and is also a registered user of Cameo, Marplot, HAZUS, DMIS, and the Consequences Assessment Tool Suite (CATS).

Mobile Terminals (optional) – These will host emergency response applications that run on mobile terminals (laptops, PDAs and cell phones) that provide Incident Commanders and their teams with timely, relevant data at the scene of an incident. Keeps field deployed units in the loop with latest common operating picture. This will be evaluated as a possible component of the Operational Exercise. It will be coordinated with Region 9 Federal Emergency Management Association (FEMA), California State Office of Emergency Services (OES), Metropolitan Transportation Commission (MTC), the Association of Bay Area Governments (ABAG), the Golden Gate Safety Network (GGSN) and the CCC Mobile Field Force and other federal, state, and local agencies.

OGC Web Services – Geospatial services that are accessible as Web resources. Consists of:

- Web Map Service (WMS) – Produces stylized maps with desired layers
- Web Feature Service (WFS) – Fetches select feature sets
- Web Coverage Service (WCS) – Fetches select (raster) coverages
- Web Registry Service (WRS) – Accesses OGC registries with metadata
- Web Tracking Service (WTS) – Determines tracking information for mobile terminals
- Sensor Collection Service (SCS) – Fetches observations from select sensors



Phases

The project will be conducted in six major phases:

- Phase I Needs Assessment, Project Refinement, and Architecture and Security Design
- Phase II OGC Critical Infrastructure Interoperability Initiative- System Design, Development and Implementation
- Phase III DMIS Integration
- Phase IV Operation Exercise
- Phase V Initial Operating Capability
- Phase VI Project Assessment and Documentation

Phase I. Needs Assessment and Architecture Development

- 1) Conduct a functional needs assessment and analysis to support system implementation. This task will include an analysis and refinement of needs as defined by DHS. Policy, procedure and technology issues will also addressed under this task.
- 2) Identify Critical Infrastructure and Key Assets for the region. Define these in terms of specific data sets that are currently produced, stored and managed across the region, along with appropriate state and federal resources. Coordinate with the MTC and the results of the Bay Area GIS Survey that was completed in 2002.
- 3) Develop the system architecture for implementing this capability. Most importantly, define the enterprise-level architecture view of the *GIF*.

Phase II. OGC Critical Infrastructure Interoperability System Design, Development and Implementation

Conduct an OGC Interoperability Initiative that leads to concrete definitions and documentation of the *GIF* and demonstrates a multi-vendor solution to geospatial interoperability in support of emergency preparedness, management and response operations. The following tasks pertain:

- 1) Starting with guidance from the BAR-GC and DHS/FEMA concerning the data content for the Critical Infrastructure and Key Asset Layers of the National Map, define the information model and applicable application schemas required as the information standards and implementation specifications portion of the *GIF*.
- 2) Based upon the Critical Infrastructure and Key Asset Layers defined in task 1, define and implement the information models and application schemas for the applicable Emergency Response and Operational Support Layers for the Bay Area. These may consist of Vulnerability Assessments, Security Plans and Emergency Preparedness Data.
- 3) Select and enhance as necessary the standards and specifications that are needed to implement the required OGC services for this system in a secure manner.
- 4) Use a multi-vendor team to implement the *GIF*, integrating the required distributed geospatial resources consisting of the Critical Infrastructure and Key Asset Layers, Emergency Response and Operational Support Layers, and supporting Foundation Layers (other identified layers of the BAR-CG and National Map).



Phase III. DMIS Integration

- 1) Working with the DHS/FEMA product team, integrate the DMIS emergency incident reporting and specific needs request application utilizing the *GIF*, fully leveraging regional/state/federal geospatial assets.

Phase IV. Operational Exercise

- 1) Employing the set of applications, *GIF*, and distributed geospatial resources, demonstrate the use of distributed geospatial resources for emergency preparedness, management and response in an Emergency Operations Center context.
 - o Access and share Critical Infrastructure and Key Assets information;
 - o Develop and share Incident Assessment results based upon an-incident scenario using the CATS, CAMEO (including MARPLOT and ALOHA) and/or HAZUS .
 - o Develop Incident Situation Assessment maps based on the incident scenario.
 - o Report the Incident to the DHS/FEMA using the DMIS tools
 - o Optional: Track field forces using GPS tracking.
 - o Optional: Update a Current Incidents Layer in the BAR-HSDS

Phase V. Initial Operating Capability

- 1) The capability resulting from Phase III will provide data and technology that will be used to implement an initial operating capability for the Bay Area, to be subsequently used in field trials and undergo continuing enhancement. The following tasks pertain:
 - o A team of select vendors will implement the Initial Operating Capability at a designated facility in the Bay Area Region.
 - o Training will be provided for BAR-GC members and operations personnel.
 - o Field trial will be conducted connecting to a BAR-GC redundancy node. (Napa is proposed)

Phase VI. Project Documentation

- 1) Lessons learned will be documented and published, with specific recommendations for next steps.
- 2) A plan will be developed to assist the BAR-GC in implementing and populating additional BAR-GC redundancy nodes.
- 3) A technology upgrade plan will be developed.

Key Project Personnel

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Summary

The project envisioned will enable sharing of critical infrastructure and key asset data and information across governmental jurisdictions through a *Bay Area Regional Homeland Security Data Server (BAR-HSDS)* and will include incident reporting via the DMIS. This system will complement national and local first responder and homeland security initiatives. The goal is to design, develop, and demonstrate an operational prototype for the San Francisco Bay Area that enables critical infrastructure and key asset data and information sharing, analysis, and reporting in a heterogeneous environment, with a system that is affordable, easy to use, and secure. BAR-HSDS will help organizations publish, discover, access, exchange, and maintain vital geospatial information required to support critical infrastructure protection, response, and recovery operations.