

# GeoWorlds: Integrated Digital Libraries and Geographic Information Systems

*<http://www.isi.edu/geoworlds>*

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## **Project Goals**

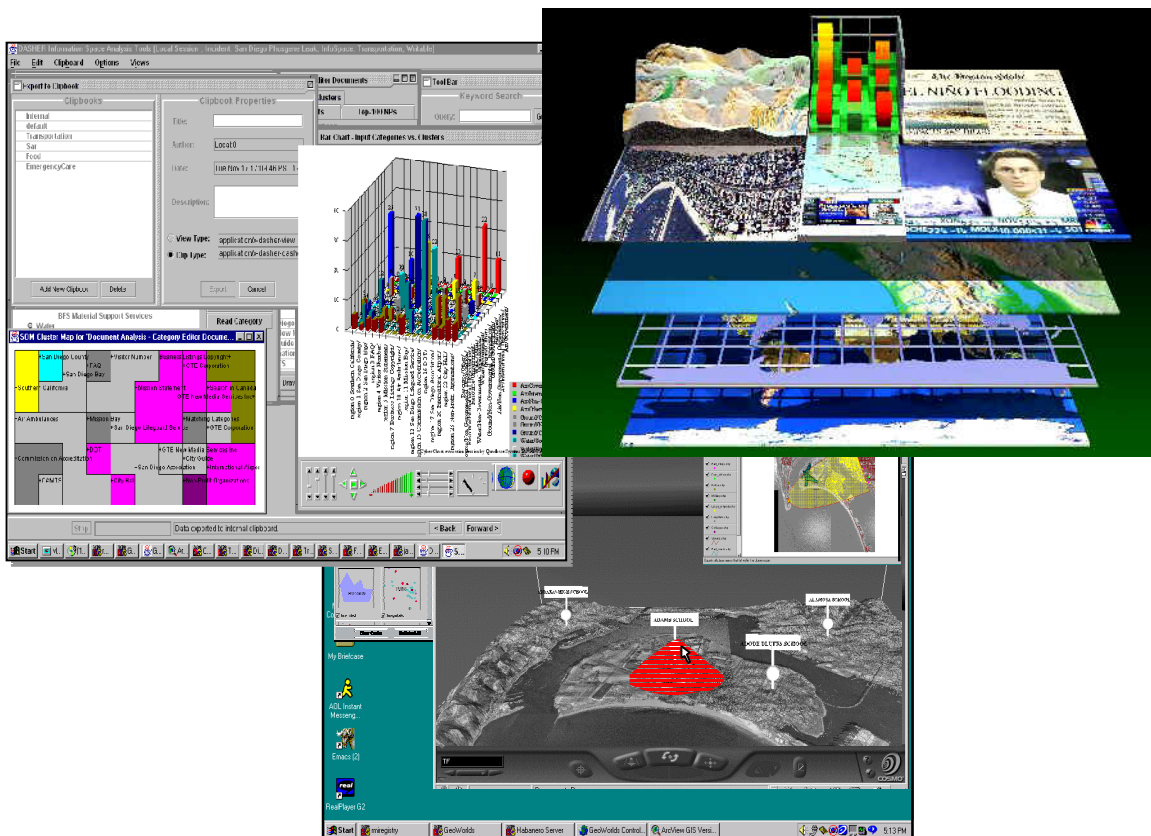
GeoWorlds is a component-based information management system aimed at helping organizations to marshal, analyze, discuss, and act on *all* of the available information about a situation playing out over space and time. The system integrates digital library, geographic information systems (GIS), and remote sensor data management technologies, together with other information analysis, retrieval and collaboration tools. It shows how users can rapidly *assemble a custom repository* of geographic information about a region, *bi-directionally link* it to collections of document-based information from the World-Wide Web, and *monitor* real-time sensor data for information that might change conclusions or decisions formed on the basis of this rich information set. This functionality is provided within a framework that enables synchronous and asynchronous collaboration over finding, filtering, organizing and visualizing the needed information.

# GeoWorlds: Core Ideas

## Goals of System

- **Marshal** everything known about a region
- **Analyze** and act on all data and information available related to situations/region
- **Monitor** the progress of events in space and time

GeoWorlds is an experimental system that demonstrates how carefully integrating three key technologies can provide teams of users with a sense of *shared regional vision* -- the ability to marshal and organize everything known about an area, displayed with respect to space and time. The system seeks to provide synergy between three technologies -- digital libraries, geographic information systems, and telecommunications of remote sensor data. It retrieves, organizes and displays available information about a region in rich displays, allowing teams of users in distributed locations to collaboratively assess situations, develop appropriate responses, and monitor the situation's evolution.



## Collaborators

USC ISI is developing GeoWorlds together with:

- USC Information Sciences Institute DASHER Project
- USC Information Sciences Institute Natural Language Group
- University of Southern California, Department of Geography
- UC Santa Barbara Alexandria Digital Library Project
- U. of Illinois at Urbana-Champaign Digital Library Initiative
- University of Arizona Artificial Intelligence Laboratory
- University of California at Berkeley Digital Library Project
- U. of Ill. National Center for Supercomputing Applications
- MITRE
- SPAWAR
- US Pacific Command and Joint Forces Command

## Technology

The system integrates USC ISI in-house tools, CoTS components and various products of other research institutes.

<b>Key Ideas</b>
<b>Collaborative geographically-based information management for proactive crisis understanding and management</b>
<ul style="list-style-type: none"><li>■ <b>Map-based creation, search, and display of document sets</b></li><li>■ <b>Integrate results from multiple searches and search engines</b></li><li>■ <b>Categorize information by existing or derived structure</b></li><li>■ <b>Collaboratively trade results in shared information spaces</b></li></ul>

GeoWorlds provides teams the ability to rapidly assemble and view a *custom* repository of information about a spatial area (geographic or otherwise). It enables them to select data sets from large samples of pre-determined information stored in GIS or other spatially organized databases, to relate these data to collections of document-based

information from the World-Wide-Web that have been found, filtered and organized on-the-fly, and to tie these to physical events possibly monitored by real-time sensor feeds.

## Capabilities

- **Rapid creation of customized repositories** of maps, images and documents from multiple spatially distributed sources
- **Bi-directional flow** between geographic and document-oriented information spaces
- **Active services:** Analytical tools for collections of documents and modeling of physical processes
- **Synchronous and asynchronous collaboration** over finding, filtering and organizing information
- **Configurable system:** service registration, API's for component classes

The current version of the system has the following key capabilities:

- Configurable system through registry of components
- Rapid creation of customized repositories of maps, images and documents from multiple sources
- Bi-directional flow between document and data view of the situation
- All operations shared within teams through a collaborative environment

## Applications

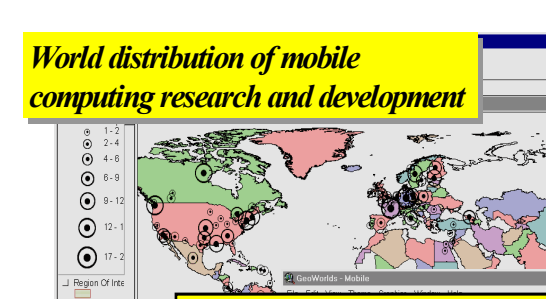
GeoWorlds has demonstrated applications in disaster consequence management, intelligence analysis at multiple levels, and scientific collaboration. For example, GeoWorlds can help a team assess a situation's impact, identify relevant resources, and evaluate geographic constraints affecting response plans. Its analysis tools can be used to delineate the affected region, retrieve collections of documents from multiple sources, and categorize these collections into groups of related topics. This lets users see what is known about the region, and thereby understand what is affected. Users can then look for nearby resources and locate what they find on maps, helping them understand options available for a response. Collaboration tools help team members with different expertise to trade information and discuss options. This and other examples are illustrated in the figures following.



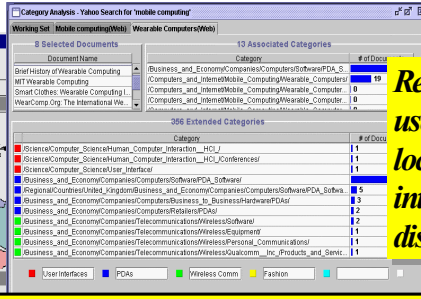


# GeoWorlds in Information Technology Assessment

**World distribution of mobile computing research and development**

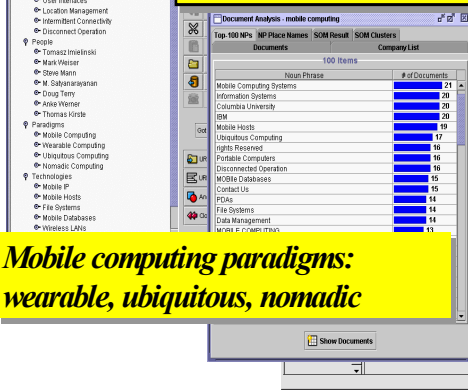


**Research issues: user interfaces, location management, intermittent connectivity, disconnected operation**



## Sample Analyses on Mobile Computing

**Mobile computing paradigms: wearable, ubiquitous, nomadic**



**Major European players: France, Germany, Sweden, Finland**



**Major Asian players: Japan, Taiwan**



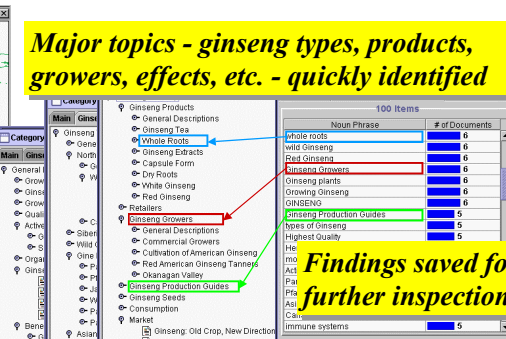
# GeoWorlds in Product Economic Viability Analysis

**Major topics - ginseng types, products, growers, effects, etc. - quickly identified**

**China, US and Japan are the biggest markets; Canada and US are the major ginseng producers along with China and Korea**

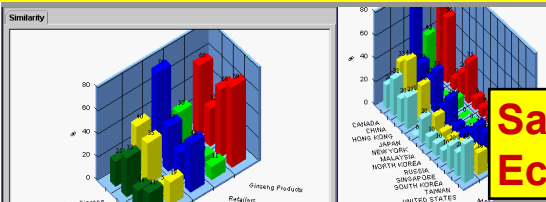


**Findings saved for further inspection**



## Sample Analyses from an Economic Impact Study (Ginseng)

**More consumption of Siberian and North American ginseng than Asian ginseng, more growers and retailers for North American ginseng**



**Major ginseng retailers and production companies**



**Canadian ginseng industry status**



**Drill-down to a specific retailer in Wisconsin**



# GeoWorlds in Disaster Relief Applications

**Hospitals in path of disaster**

**Region impacted**

**Sample Biochem Incident Analyses**

**Sensor data indicating that actual effects differ from predicted spread of toxin**

**Transportation Information Space for San Diego region**

**Resources available to respond**

**Candidate resources for moving medical supplies (identified and mapped)**

# GeoWorlds in Other Geo-Spatial Related Domains

**Spatial Information Management Applied to Molecular Structures**

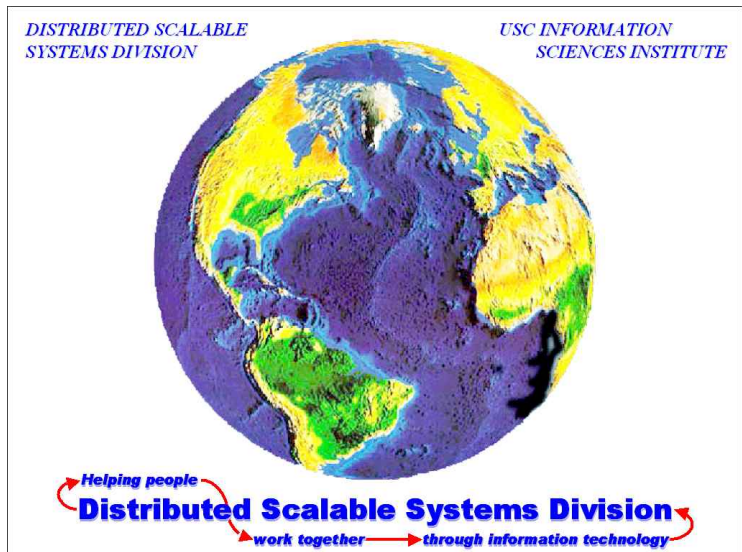
**Document collections tied to 3-D models**

**Molecule visual elements seed document searches**

**Linked alternative visualizations**

## USC ISI's Distributed Scalable Systems

**Division** innovates and integrates advanced technologies that help distributed collections of humans, software, and machines coordinate and act to analyze and manipulate their environments -- rapidly, effectively, and securely.



<http://www.isi.edu/divisions/div2/index.html>

The Division engages in science, applications, and integration projects on all aspects of systems that explore, sense, and alter the world. Our research is premised on the critical trends of the next decade: widely disseminated, highly distributed computing in a highly connected world. In that context, the division explores the design and use of very large systems that integrate people, software, information processors, sensors, and actuators as potential elements.

Issues of scale are explored across many dimensions, with a particular focus on scaling in size, heterogeneity, and distribution of components. Multiple levels of systems research and development are ongoing. The Division supports research on individual components, with a particular emphasis on assistive tools (software and hardware components that augment human analytic, sensory, or physical capabilities). Interfaces and interconnections that support the assembly of components into larger systems are also of great interest, as are mechanisms for monitoring and controlling complex systems.

The common theme across all efforts is rapid response enabled by effective and secure use of web-connected assets.

### For More Information

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