Response to

Call for Participation (CFP)

OGC - GEOSS Pilot 2008

Southeastern Universities Research Association (SURA)

National Incident Management Systems and Advanced Technologies (NIMSAT)

Gulf of Maine Ocean Observing System, Inc. (GoMOOS)

20080901

1. Overview

This document expresses the willingness of the Southeastern Universities Research Association (SURA) the National Incident Management Systems and Advanced Technologies (NIMSAT) and the Gulf of Maine Ocean Observing System (GoMOOS) to participate in the Phase 2 GEOSS Architecture Implementation Pilot (GEO Task AR-07-02).

The NIMSAT web-based Community and Education Outreach (CEO) portal would enable individuals and local communities to visualize the all-hazard risk for a geographic region as interactive GIS maps. The risk is demonstrated as a numerical index, thus allowing the user to intuitively anticipate the impact from a disaster to their selected region of interest. This information will also help emergency management officials in planning and making critical public safety decisions during disasters. The risk information will be accessible as both Web Map Services (WMS) and Web Feature Services (WFS), thus it can be further interfaced with other GEOSS applications.

Prediction of risk during or immediately before an impending disaster requires integrating the outputs of forecast models such as dynamic weather and storm surge prediction models, into the disaster risk model. ADCIRC is a coastal circulation and storm surge model that predicts the inundation and water levels at different locations. These inundation levels would help in predicting the risk of a region from inundation. The SURA Coastal Ocean Observing and Prediction (SCOOP) program provides the water-level and wave forecasts from ADCIRC and other models in a variety of formats: NetCDF, Web Map Services (WMS) and Web Feature Services (WFS).

SURA/SCOOP will also make available a catalog for sensor services that are served in the OOSTethys Project (www.OOSTethys.org), The OOSTethys project has been experimenting with Sensor Observation Services and initiated the OGC Ocean Science Interoperability Experiment which recently reported best practices about SOS implementations.

GoMOOS has been working with National Weather Service (NWS) forecast office of the National Oceanic and Atmospheric Administration (NOAA), as well as the local emergency response community in the northeast region, to prototype a coastal hazard prediction tool for coastal geohazards arising from storm impacts. The prototype web-based, decision-support tool leverages has been developed in the State of Maine and is being adapted to Massachusetts. It leverages SCOOP program services (WMS and WFS) as well as Sensor Observation Service (SOS) implementations for real-time GoMOOS buoy observations in the Gulf of Maine. This tool provides analogous capabilities with the NIMSAT tool, and part of the goal of this implementation pilot will be to investigate commonalities that can be leveraged by global communities to limit loss of life and reduce property damage from natural disasters along the coast.

SURA/SCOOP, GoMOOS and NIMSAT team will explore other issues in the context of a GEOSS environment, such as using OGC standards services for forecast data. NIMSAT is also

exploring the usability of other GEOSS services for the modeling of all-hazard risk. Furthermore, NIMSAT is planning to harvest other disaster data using standardized services, and also register the all-hazard map services in a GEOSS standard format.

Issues to address:
- Work with the emergency management community in Northeast U.S. and Northern Gulf of Mexico on needs-based application of these tools,
- Apply OGC standards to support decision tools for coastal storm and hurricanes impacts that mitigate property loss and save lives,
- Automatic discover mechanism for a data of interest using the GEOSS registry (e.g. inundation forecast),
- Automatic parsing of the data being requested (time series, coverages, images etc.) to feed the risk model,
- Content information required in the model output and services so that the model output is discoverable and properly used,
- Processes for updating available services and data.

2. Proposed Contributions

2.1. Societal Benefit Area Alignment and Support

The Societal Benefit Area (SBA) that the aligned partnership of SURA, NIMSAT and GoMOOS would contribute to, is the **Communication of Disasters, and Mitigation of Post-Disaster Damage** to the general public and businesses**.** The disaster response section 2.6.1 in Annex B of the CFP discusses the flooding scenario. SURA and NIMSAT would like to enhance this scenario by providing numerical model simulations and a community marine catalog of sensor observations. This will complement the available and complementary sources, such as satellites and other sensor networks.

NIMSAT team would provide the risk maps based on the historical disaster data and disaster forecast models such as ADCIRC. GoMOOS would conduct outreach to emergency response community in partnership with NOAA, SURA/SCOOP would provide the results of numerical models for water level, waves, and inundation forecast as input to the NIMSAT risk model and GoMOOS decision tools.

The numerical models run 24/7 on a distributed computing network. Products from these simulations support a variety of activities, such as decision-tool prototypes and verification tools. Collectively, these shared data and resources are prototyping a Distributed Coastal Laboratory" (DCL) that allows the scientific community to improve coastal predictions.

2.2. Components and Service Contributions

SURA and NIMSAT will provide components to the GEOSS architecture. To better explain the components, terminology from Section 5, Annex B of the CFP, will be utilized. In particular, it will be refer to Figure 31 of the CFP, which provides a set of component types organized by service tiers.

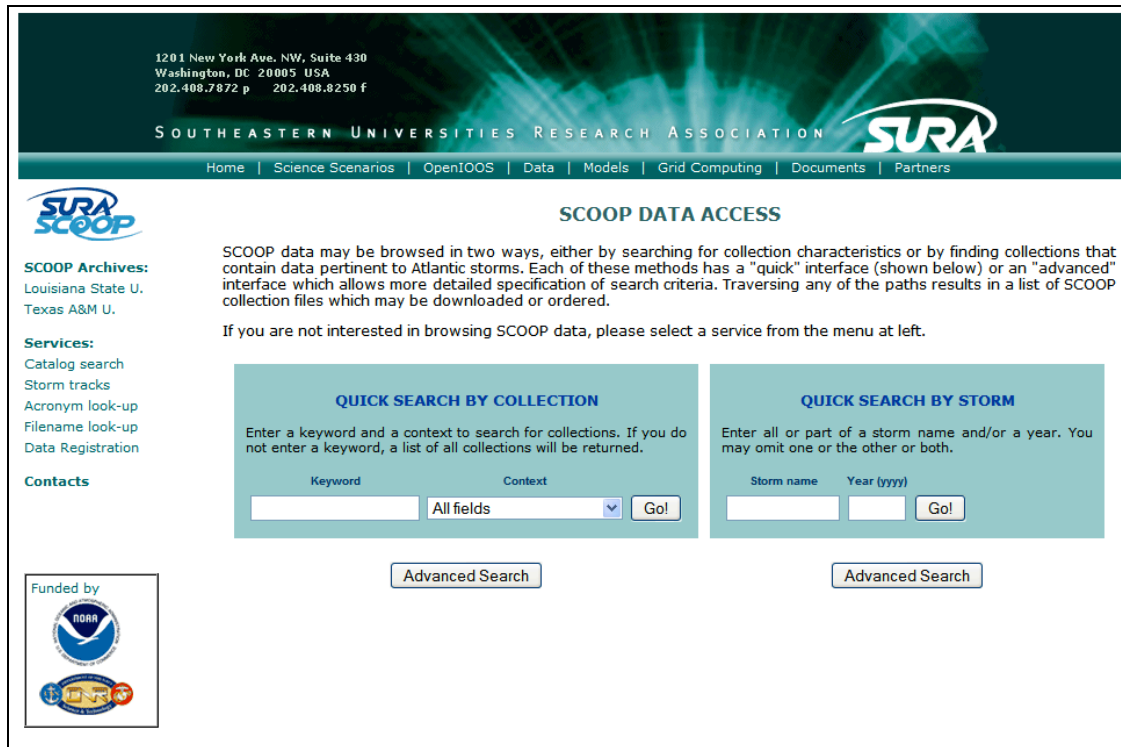### 2.2.1. Model Access Services

2.2.1.1 ADCIRC

- Description: ADCIRC - water level, waves, and inundation ensemble forecast
- Access Data Service: WMS / WFS and NetCDF
- Process: Registration to a GEOSS Registry the available web services
- Performance Capability: . The exact performance limits of the functionality has not been tested
- Availability of Components: 24/7

2.2.2. Data and Service Registries

SURA/SCOOP maintains a data catalog/registry of all the data generated from the SCOOP coastal models, as well as many of the related input data sets, and a service registry for functionality related to observational data. This information is maintained in real-time for ongoing SCOOP modeling and prediction activities.

2.2.2.1 SCOOP Data Catalog (registry)

This catalog provides a centralized view of data available across multiple distributed data archives. SCOOP maintains proprietary catalog services for internal use, but also provides Z39.50 query access to FGDC-compliant records of the catalog contents. This capability is registered with the NSDI Clearinghouse and can be made available to the GEOSS community as well. User access to the current SCOOP Data Catalog is available at the following location (http://scoop.sura.org/Catalog)

2.2.2.2 OOSTethys Service Registry

Associated with the SCOOP project, the MMI/OOSTethys interoperability demonstration project has developed a service registry for Sensor Observation Services (SOS), a recent OGC approved standard. This registry employs OGC standard GetCapabilities method to harvest metadata for the sensors and the observation offerings. Although, the registry has served the purpose of discovery of services with various parameters and variables, it lacks a community accepted standard.

2.2.2.3 Catalog Services for the Web (CSW) Support

The SCOOP catalog team (UAH) will undertake a development effort of providing OGC CSW service access to both the SCOOP Data Catalog and the MMI/OOSTethys Service Registry. The CSW interfaces would further the interoperability of the SCOOP resources with the GEOSS registry activity. This implementation will also be available as a reference implementation to assist other data providers with similar efforts.

2.2.2.4 Performance Capability

The SCOOP Data Catalog supports the daily ingest of metadata for hundreds of model output data granules from distributed modeling resources through web service interfaces. Likewise the services are utilized daily by several applications and tools supporting user queries for metadata information on data collections and the available inventory. The exact performance limits of the functionality has not been tested, but there have not been any performance-related problems with the system from current SCOOP production activities.

2.2.3. Client Applications

2.2.3.1 NIMSAT - CEO portal

The NIMSAT Risk portal currently has the capability to visualize the risk of a geographic region, based on the damage accrued due to the natural disasters that occurred in that region in the past. These damages include property damage, injuries and fatalities. Figure 1 illustrates an example scenario showing the risk to the State of Louisiana based on the property damage from historical natural disasters. With the availability of data from forecast models like ADCIRC, we plan to communicate predictive risks to communities based on various factors including geographical location, forecast data such as inundation levels, historical data and other socio-economic factors. The historical data harvesting models and the hazard risk models will be hosted at NIMSAT.

Because of the heavy volume of the data from forecast models and high dimensionality of the socio-economic data, the computationally intensive part of risk modeling will be supported by the supercomputing infrastructure at NIMSAT (see the performance capability section for more information on resources) through LONI and TeraGrid. Furthermore, the portal will support dynamic visualization of risk at various levels of spatial granularities, such as state level, and parish level.
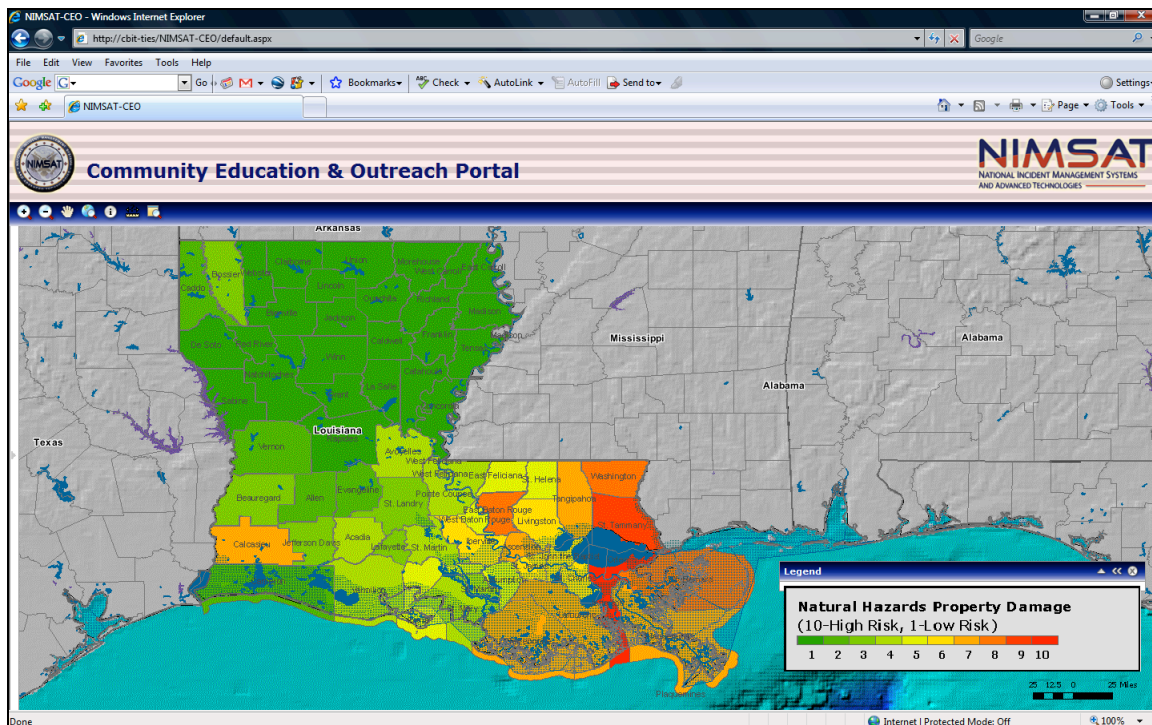

Figure 1: Estimated Risk based on Historical Data at Parish Level.

Access Data Services

- We will use the OpenGIS Web Map Service (WMS) to produce spatially referenced risk maps dynamically.
- WFS for querying regions with similar spatial constraints and risk factors
- WPS for dynamic calculation of risk based on selected spatially-referenced data

Performance Capability

NIMSAT has access to the state-of-the-art supercomputing (LONI, TeraGrid) and visualization (LITE) facilities. These resources will be leveraged by the NIMSAT's data collection and risk models to support the services required by the CEO portal.

Availability: 24/7

2.3. *Architecture and Interoperability Arrangement Development*

NA

3. Description of Responding Organization

3.1. Southeastern Universities Research Association (SURA)

3.1.1. Description

SURA is a consortium of over sixty universities across the US. SURA jointly operates the Thomas Jefferson National Accelerator Facility on behalf of the US Department of Energy through Jefferson Science Associates, LLC - and runs the SURA Residence Facility. SURA also promotes initiatives in nuclear physics, information technologies, coastal research and technology commercialization.

SURA, is willing to be a *Participant Organization* within the Pilot Experiment. SURA, within its coastal research is interested in sharing its experience in the development of coastal information systems and in advancing standards in the geospatial domain. SURA's systems are based on service-oriented architectures and include: services, clients, visualization portals, distributed archives, and catalogs. SURA data available via OGC web services include real time observations and forecasting of water level, waves, and inundation.

3.1.2. Human Resources Contributions

Name	Category	Estimated monthly contribution
Luis Bermudez - SURA	Systems Architect	10 hours (including telecoms)
David Forest - VIMS	Research Scientist	5 hours
Matt Smith - UAH	Research Scientist	5 hours
Manil Manski - UAH	Computational Scientist	5 hours
Charlton Galvarino - TAMU	System Engineer	5 hours
Gerry Creager - TAMU	Research Scientist	5 hours
Howard Lander - RENCI	Research Scientist	5 hours

3.1.3. System Resources Contributions

Type	Description
TAMU - Web Server	Web Server that responds to request for forecast data.
UAH - Web server	Web Server that responds to request for forecast data.
Individual PCs	For accessing web, diagramming etc.

3.1.4. Contacts

Business/ Financial Contact Information:	Technical Contact Information
Joanne Bintz Program Manager Coastal Research Southeastern Universities Research Association (SURA) Tel: (202) 408-7872 Email: bintz@sura.org 1201 New York Ave. NW Suite 430 Washington DC 20005 USA	Luis Bermudez Coastal Research Technical Manager Southeastern Universities Research Association (SURA) Tel: (202) 408-8211 Email: bermudez@sura.org 1201 New York Ave. NW Suite 430 Washington DC 20005 USA

3.2. NIMSAT

3.2.1. Description

UL Lafayette's NIMSAT Institute is an integrative partnership of over 35 public and private sector organizations from across 16 states in the US, whose R&D assets and capabilities are respected by practitioners across the country (shown in Table 1).

UL Lafayette is a national leader among universities for its accomplishments in both research and homeland security tools and applications. The NIMSAT Institute seeks to be a Center of Excellence in the field of emergency management and homeland security, leveraging over $100M investments into supercomputing, 3-D visualization, and networking investments of the Louisiana Immersive Technology Enterprise (LITE), Louisiana Optical Networking Initiative (LONI) and the TeraGrid to solve real-world emergency management problems and provide both tools and applications to support decision-making in times of crisis.

3.2.2. Human Resources Contributions

Name	Category	Estimated monthly contribution
Pavani Kuntala (NIMSAT)	Research Scientist	10 hours (including telecoms)
Raju Gottukumkkala	Computational Scientist	10 Hours

3.2.3. System Resources Contributions

Type	Description
CEO Web Server	Web Server that responds to request for Risk data.
NDD Web server	Web Server that responds to request for Disaster data.
Individual PCs	For accessing web, diagramming etc..

3.2.4. Contacts

Business/ Financial Contact Information:	Technical Contact Information
Ramesh Kolluru, Ph.D. Assistant VP for Research and Graduate Studies Executive Director, National Incident Management Systems and Advanced Technologies (NIMSAT) Institute Director, Center for Business & Information Technologies (CBIT) University of Louisiana at Lafayette Office: (337) 482-0611 Email: kolluru@louisiana.edu	Pavani Kuntala Research Scientist National Incident Management Systems & Advanced Technologies (NIMSAT) Institute University of Louisiana at Lafayette Office: (337) 482-0630 Email: pxk5561@louisiana.edu

3.3. Gulf of Maine Ocean Observing System, Inc. (GoMOOS)

3.3.1. Description

GoMOOS, Inc. is a nonprofit membership organization and a regional component of a national program designed to bring hourly oceanographic data to all those who need it. GoMOOS is involved in several projects that are establishing new levels of interoperability and integration between other regional systems like GoMOOS, as well as state and federal agencies that collect their own information about the coastal ocean. The goal is an integrated set of interoperable and distributed observing systems producing top quality data and information products for both research and practical applications. For data integration and product services, GoMOOS is implementing and helping to advance open standards developed by the World Wide Web Consortium, the Open Geospatial Consortium. GoMOOS has been helping advance the U.S. initiative to establish an Integrated Ocean Observing System (IOOS), which is intended to be the U.S. contribution to GOOS. Dr. Philip Bogden, CEO of GoMOOS, also is also Director of the SCOOP program at SURA.

3.3.2. Human Resources Contributions

Name	Category	Estimated monthly contribution
Philip Bogden	CEO & SCOOP Director	10 hours (including telecoms)
Tom Shyka	COO	2 hours
Riley Young-Morse	Product Manager	10 hours
Eric Bridger	Software Engineer	10 hours

3.3.3. System Resources Contributions

Type	Description
OpenIOOS.org	Production web server with data aggregation & services
GoMOOS.org	Production web server with decision tools
Development servers	Software development and backup production capacity

3.3.4. Contacts

Business/ Financial Contact Information:	Technical Contact Information
Philip Bogden, Ph.D. CEO for GoMOOS Director of the SCOOP Program at SURA 350 Commercial Street Portland, ME 04101 Office: (207) 773-0423 Email: Bogden@gomoos.org	Riley Young-Morse Product Developer GoMOOS 350 Commercial Street Portland, ME 04101 Office: (207) 773-0423 Email: riley@gomoos.org