

# SeaMaven: A Web-based Virtual Learning Environment

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## 1 Introduction

Researchers at the Georgia Tech Research Institute (GTRI) and the Skidaway Institute of Oceanography (SkIO) have partnered on an NSF funded program to develop SeaMaven, a prototype virtual learning environment (VLE). SeaMaven is designed to enable middle school science students to actively engage in collaborative learning in the environmental sciences. The application provides students with a web-based interface to an offshore observational network of platform-based sensors for monitoring oceanographic and meteorological processes. Students can use SeaMaven to make atmospheric and hydrology measurements of the marine environment off the Georgia/South Carolina coast in near real-time.

The technologies that make this program possible have been developed by Skidaway scientists over the course of the last several years, through their work on the South Atlantic Bight Synoptic Offshore Observational Network (SABSOON). The SABSOON program makes use of eight offshore platforms owned and operated by the U.S. Navy. These platforms are situated approximately 60 miles offshore on the southeastern continental shelf. The system of environmental sensors and broadband telecommunications facilities that they support is designed to provide project researchers, and eventually scientists worldwide, with a continuous stream of information on coastal ocean conditions from this important and fragile ecosystem. The intent is to develop an offshore facility that can host a variety of scientific, educational, and environmental monitoring applications. SeaMaven provides an important outreach component for this program.

## 2 Application Design

The prototype module developed for phase one of SeaMaven provides the navigational elements, introductory material, and interactive components essential to enabling students to fully access and manipulate a subset of the available sensor data from two of the eight platform arrays. Graphical representations of the sensor readouts are designed to afford the budding young scientist with a genuine feeling of presence. A guided tour of the Web site, one or two introductory activities, and links to other relevant online resources that maintain collections of meteorological, oceanographic, and similar data are also features of the site at this stage. The guided tour provides an automated overview of the application that gives the user a “mental map” of the site’s layout and its navigational features. The introductory activities provide hands-on experience at understanding and navigating the data. Throughout the user experience, students are provided with multiple avenues for acquiring knowledge through interactions with text, still images, audio, video, and animations. A simple VRML-based treasure hunt style game is also under development

as a fun learning tool for exploring the underwater environment in the vicinity of the towers.

The interface through which visitors enter and navigate SeaMaven provides access to a virtual tour of the research facilities at Skidaway and also serves as a portal to the 5,700 square kilometer area of the continental shelf that is monitored by the SABSOON systems. Visitors to the site first encounter a click-through splash screen followed by an interactive map of the South Atlantic Bight. A main menu provides deeper access to the site along with basic introductory material and a login entry for registered users. Clicking on one of the platform icons highlighted on the map screen transports the visitor to one of the SABSOON tower data display screens. Here, the visual layout of the site changes to reveal a graphic of the selected tower and instrument readouts that update automatically to display the most recent data acquired from each of the platform’s sensor arrays. By clicking on the compass rose at the bottom of each screen, visitors can summon a popup map to navigate among the available platforms from any point within the site. Visitors may also select an icon representing the Skidaway facility on the Georgia coast where they can tour the research laboratories via interactive QTVR panoramic movies.

SeaMaven is structured to accommodate the needs of two types of users: the casual visitor, and registered students and teachers. While all visitors have access to the real time data stream, registered users are granted deeper access to comprehensive learning activities and enhanced functionality that is unavailable to the casual visitor. A PHP-driven server-side database enables a unique student identifier so that teachers can track student activity and progress if so desired. Teachers who register their students will have direct access to these tracking features along with functions for adding, editing, and deleting student accounts.

## 3 Further Development

Phase II development efforts will focus on enhancing the presentation of the real-time data stream through event monitoring of the tower environment. 2-D Animations will provide visual feedback on current conditions at the tower sites, mirroring weather and sea-state activity based upon sensor readings of parameters such as barometric pressure, wind speed, relative humidity, and wave height. Future modules will also include additional learning activities for students and teachers that involve greater access to, and understanding of, the online data. These activities will present problems and simulations that go into greater detail on topics such as how wave height and periodicity are calculated or what natural events affect algae blooms and dissolved oxygen in ocean waters. The site will also provide templates for teachers to develop their own lesson plans and instructional vignettes using the data sets archived on the site. As in Phase I, all templates and learning activities will be developed

in collaboration with educators and project scientists. Future development will also be extended to include monitoring buoy data at nearby Gray's Reef National Marine Sanctuary and estuarine sensor measurements generated through the NSF funded Long-Term Ecological Research program at Sapelo Island, Georgia. SABSOON scientists are also involved in initiatives to develop broader regional and national networks of coastal observing systems. Thus the educational modules developed in this pilot project can serve as models for web-based learning tools that access real-time and archived data from along the entire U.S. coast.