GCOOS Build-out Plan for a Gulf Observing System
Opportunities for Marine Technology Development and Applications

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MTS Oceans in Action Workshop
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Overview - GCOOS Build-out Plan is:

- **Effective**
  - observations based on 10 years of identifying broad stakeholder needs

- **Efficient**
  - founded in existing systems and capacities in the Gulf

- **Economic Opportunity**
  - for public and private entities

USM and Liquid Robotics, Inc. collaborate with NOAA and the GCOOS-RA to deploy a Wave Glider to monitor ocean acidification in the Northern Gulf. (Credit: USM)

Effective:

Based on 10 years of identifying stakeholder needs

GCOOS Mission

GOMA Priorities
e.g., water quality, nutrients and nutrient impacts, environmental education

Plans and Reports
identifying and integrating Gulf monitoring needs by State & Federal Agencies, NGOs, academic consortia

GCOOS Stakeholder Priorities

17 GCOOS Stakeholder Workshops
w/ partner participation (e.g.,GOMA, SECOORA, NOAA), 631 participants

GCOOS Products and Services Advisory Council

Direct Expert Input
10 teams + >50 indivs.

GCOOS Education and Outreach Council

See Workshop Reports at http://gcoos.tamu.edu/?page_id=391

Effective:

Stakeholder workshops held to identify needs

Name	Dates	Location
The Gulf of Mexico Regional Workshop on an Integrated Data System for Oceanography	31 October-2 November 2000	Stennis Space Center, MS
The NVODS Workshop for Managers of Coastal Observing System Activities in the Gulf of Mexico	14-15 January 2003	Stennis Space Center, MS
A Workshop to Explore Private Sector Interests and Roles in the U.S. Integrated Ocean Observing System; Focus on the Southeastern U.S. and Gulf of Mexico	2-4 March 2004	Marathon Oil Company, Houston, TX
The HABSOS-GCOOS Workshop	13-15 April 2004	St. Petersburg, FL
The Next Steps in the Gulf of Mexico	7-8 July 2004	College Station, TX
The GCOOS and the Private Sector: Oil and Gas and Related Industry Workshop	2-4 November 2005	Houston, TX
The GCOOS-SECOORA-NOAA CSC Storm Surge & Inundation Workshop	24-26 January 2007	New Orleans, LA
First GCOOS-GOMA Workshop on a Harmful Algal Bloom Observing System Plan for the Gulf of Mexico	14-16 November 2007	New Orleans, LA
The Eastern Gulf of Mexico Recreational Boaters Workshop	4-5 February 2009	St. Petersburg, FL.
Second GCOOS-GOMA Workshop for a Harmful Algal Bloom Integrated Observing System Workshop	21-23 April 2009	St. Petersburg, FL
The Western Gulf of Mexico GCOOS Educator GPS Workshop	23-24 April 2009	Corpus Christi, TX
The Eastern Gulf of Mexico GCOOS Educator GPS Workshop	30 April – 1 May 2009	Dauphin Island, AL
The Western Gulf of Mexico Recreational Boaters Workshop	28-29 May 2009	Clear Lake, TX
GCOOS-GOMA-SECOORA Ecosystem Modeling Workshop	14-16 October 2009	St. Petersburg, FL
Third GCOOS-GOMA HABIOS Workshop	26-28 March 2012	Pensacola, FL
Southwest Florida Potential Water Quality Providers Workshop	28 June 2012	Sanibel, FL
Integrated Water Quality Network meeting	12 March 2013	New Orleans, LA
Ecosystem Modeling Workshop	7-8 April 2014	Houston, TX
GCOOS Workshop with Non-Governmental Organizations	10-11 June 2014	Houston, TX

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Efficient
Plan identifies common stakeholder priorities

Priority Product or Data	Stakeholder Sectors
Obtain accurate bathymetry and topography with consistent vertical control between data sets in the coastal zone, including locations of shorelines.	Emergency managers, surge modelers, recreational boaters (bathymetry and shorelines), urban planners and developers, insurance industry (topography and shorelines), oil and gas, marine transportation (shorelines and navigationally significant waters, especially federally mandated channels, approaches, and anchorages)
Improve coverage of real-time currents in the coastal zone and navigable estuaries using HF radars as primary technique.	Marine transportation, recreational boaters, oil and gas sector, Coast Guard SAR
Improve real-time, offshore meteorology measurements (V, P, T, H).	Oil and gas sector, Coast Guard SAR, surge modelers, HABs monitoring, recreational boaters
Improve forecasts and nowcast models of sea lever, winds, and waves; this requires added real-time measurements.	Recreational boaters, oil and gas sector, Coast Guard SAR, storm surge modelers, emergency managers
Improve hurricane severity forecasts.	Emergency managers, oil and gas sector, recreational boaters
Improve forecasts and nowcasts of surface currents offshore.	HABs tracking, oil and gas sector, Coast Guard SAR
Improve severe weather monitoring, forecasting, and dissemination.	Oil and gas sector, recreational boaters, HABs tracking and fate
Enhance measurements of water quality parameters.	Oil and gas sector, recreational boaters, HABs detection and fate
Implement a modern, real-time current and water level observing system in all major ports.	Marine transportation, recreational boaters
Establish coastal storm surge/inundation maps for mitigation planning (not real time).	Oil and gas sector, insurance, real estate, planners, emergency managers
Improve information on and forecasts of visibility.	Coast Guard SAR, recreational boaters
Produce upper ocean profiles of temperature, salinity, and currents.	Oil and gas sector, recreational boaters (near artificial reefs and major diving locations
Produce reliable forecast maps of three-dimensional currents offshore.	Oil and gas sector
Improve real-time forecasts of coastal inundation.	Emergency managers, general public
Increase number of stations monitoring HABs.	Public and animal health officials, HABS monitoring network
Improve data and product dissemination techniques taking into account the sophistication of the user.	Requirement of all sectors

Efficient:
Plan includes 19 elements to meet common stakeholder priorities, with cost estimates

- Surface currents and waves network
- Fixed mooring network
- Autonomous meteorological measurement network,
- Glider and AUV network
- Satellite observations and products
- Aircraft observations
- Bathymetry and topography mapping network
- Water level network
- Enhanced PORTS® network
- Outreach and Education

- Harmful Algal Bloom Integrated Observing System
- Ecosystem monitoring
- Water quality and beach quality monitoring
- Hypoxia monitoring
- Monitoring of river discharge
- Physical modeling
- Ecosystem modeling
- Data management and communications system
- Research – input into new technology development

Efficient:

Match of stakeholder-based elements in GCOOS Build-out Plan to RESTORE priorities

RESTORE Priorities – Common Themes Across S.1603,1604,1605	GCOOS Build-out Plan Elements Examples
Restoration and protection of fish, wildlife, and natural resources	Integrated Water Quality Monitoring Network, Ecosystem Monitoring, Ecosystem Modeling, Hypoxia Monitoring, data management, O/E
Restoration and protection of marine and coastal resources, including barrier islands, beaches, and wetlands	Bathymetry and Topography, River Discharge Monitoring, Enhanced Water Level Network, PORTS, Ecosystem Monitoring, Surface Currents and Waves Network, data management, O/E
Restoration and protection of ecosystems	Ecosystem Monitoring, Ecosystem Modeling
Observing and monitoring	Observing System (14 Elements)
Restoration and protection of economy, sustainable development and sustainable technology	PORTS, Research and Development, Circulation Modeling, Beach Monitoring

Efficient:

Plan includes observations to help protect valuable ecosystem services

Ecosystem Services (NAS, 2013)	GCOOS BOP V.2.0 Section Examples
Provisioning services (e.g., material goods such as food, feed, fuel, and fiber)	Fisheries Monitoring, Physical and Ecosystem Modeling,
Regulating services (e.g., climate regulation, flood control, water purification)	River Discharge to the Gulf, Enhanced Water Level Network, Integrated Water Quality Network, Autonomous Meteorological Stations, Harmful Algal Bloom Monitoring
Cultural services (e.g., recreational, spiritual, aesthetic)	Beach Quality Monitoring, Surface Currents and Waves Network
Supporting Services (e.g., nutrient cycling, primary productions, soil formation)	Integrated Water Quality Monitoring, Hypoxia Monitoring, Plankton Monitoring

NAS. 2013. An Ecosystem Services Approach to Assessing the Impacts of the Deepwater Horizon Oil Spill in the Gulf of Mexico

Efficient:

Plan elements based on existing systems and capacities in the Gulf

- CenGOOS (MS)
- WAVCIS (LA)
- LUMCON (LA)
- NDBC Buoys, NOAA PORTS, NOAA NWLON (Gulfwide)
- DISL (AL)
- COMPS (FL)
- TABS (TX)
- TCOON (TX)

Texas Automated Buoy System buoy for oil spill response (Credit: TAMU GERG)

- Data Portal (Data available from single site, Gulfwide)
- Physical and Ecosystem Modeling Expertise (Gulfwide)
- Outreach and Education (Gulfwide)

Efficient:
## Public-Private Partnerships Example

- Drs. Li and Rouse (LSU), used ADCP data from the oil and gas industry, and publicly served through the GCOOS Data Portal and NDBC, to better understand Gulf Currents

- ADCP data through MMS Notice to Lessees (NTL); GCOOS-RA and NDBC played critical roles

- Good PR for the oil and gas industry to have their data used by the public.

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LSU Study Uses Oil and Gas Industry Data To Understand Gulf of Mexico Currents

Posted on Friday, August 8th, 2014 at 1:22 pm

Drs. Chunyan Li and Lawrence Rouse, Jr. at Louisiana State University (LSU) have completed a study of how ocean currents move in the Gulf of Mexico, using data provided by the oil and gas industry.

(From GCOOS) – The study, funded through the U.S. Bureau of Ocean Energy Management (BOEM) Environmental Studies Program (ESP), uniquely shows how the oil and gas industry and public agencies and universities can collaborate to provide important public information.

(Click to enlarge). Satellite image from May 24, 2010 of the oil spilled from the Deepwater Horizon. (Credit: NASA/GSFC/MODIS Rapid Response)

The study's results provide insight into how the Gulf of Mexico currents move, which is critical for improving oil spill response, protecting the safety of the 40,000 citizens working in the Gulf offshore oil and gas industry, and understanding the development and characteristics of hurricanes.

Ocean current profile data from an unprecedented number of oil and gas platforms (>50) in the northern

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Economic Opportunities

- Plan identifies priority stakeholder needs/gaps for marine and marine-related technology development and applications

- Following slides show examples from the Ecosystem Monitoring Section of the plan…
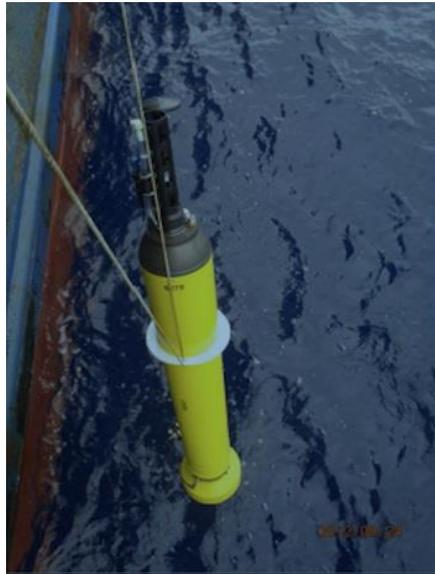
APEX Bio-optical Profiling Float (Credit: CANEK group, CICESE). Built by Teledyne- Webb Research, Inc. Deployed in the Gulf with BOEM funding for 17 months after Deepwater Horizon oil spill. (Green et al., 2014))

Green RE, Bower AS, Lugo-Fernández A (2014) First Autonomous Bio-Optical Profiling Float in the Gulf of Mexico Reveals Dynamic Biogeochemistry in Deep Waters. PLoS ONE 9(7): e101658.

Economic Opportunities
Ecosystem Monitoring Section:

Examples of new technology development and applications needs

- Technologies to rapidly detect virulent strains of Vibrio pathogens

- Technologies to rapidly detect more HAB species

- Observing technologies that can be deployed on oil and gas platforms while minimally impacting safety, operations, engineering requirements (e.g., size, power/maint. reqs.)

- Methods to minimize bio-fouling of observing instruments

- Rapid bathymetric data collection and product development

- Efficient, reliable chemical sensors (nutrients, hydrocarbons)

Economic Opportunities
## Ecosystem Monitoring Section:

Examples of needs for adapting existing technologies and methods

- Methods of collecting passive acoustics data to reduce data intensity for rapid transmission and storage (e.g., development of matching algorithms)

- Enhanced processing of satellite data and integration with data from, e.g., air- or ship-based LiDAR, gliders, buoys

- Dev. of optical sensors that can operate in turbid waters

- Dev. of observing techs. to operate in highly-stratified waters

- Development of "hardened" observing technologies that can withstand hurricanes and provide info. on the storms

- Development of cabled observatory that can provide real-time data from the seafloor

Economic Opportunities
Ecosystem Monitoring Section:
Workforce Development Needs

- Information Analysts and Modelers – to combine disparate data sets and develop useful information products for decision-makers

- Cyberinfrastructure

- Communications from deep sea

- Providers using ocean observations and offering data products via subscriptions

- Marine Technology Innovators – real-time, resistant to biofouling, enhanced detection….
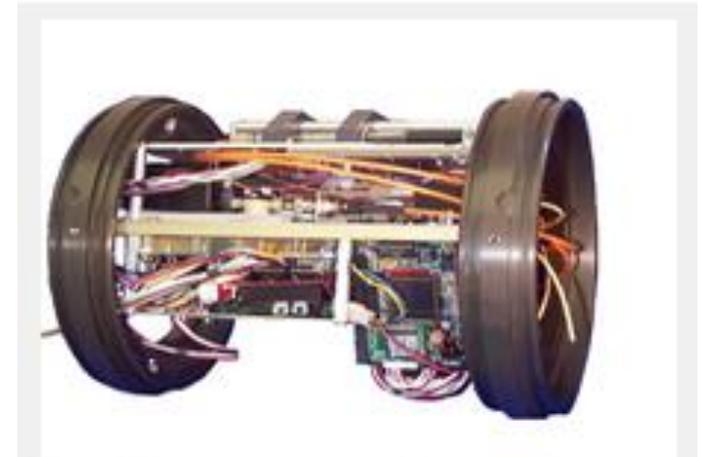
BreveBusters, or red tide sensors, are part of a new system designed to monitor automatically for red tide and create an early-warning system. Image courtesy of G. Kirkpatrick.

Summary - The GCOOS Build-out Plan is:

- Effective – observations based on stakeholder needs
- Efficient – founded in existing systems and capacities in the Gulf and developed for multiple stakeholder needs
- Economic Opportunity – for public and private entities
  - Developing new technology and methods
  - Adapting technologies and methods
  - Workforce development
- **Evolving** - we need your input & help to implementhttp://gcoos.tamu.edu/BuildOut/BuildOutPlan-V2.pdf

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