An ACT 2000 Workshop Report

A Workshop of Developers, Deliverers, and Users of Technologies for Monitoring Coastal Environments:

Targeting the Technical Monitoring Needs of Coastal Scientists and Environmental Resource Agencies

Solomons, Maryland
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Sponsored by the Alliance for Coastal Technologies (ACT), a NOAA initiative funded through the Coastal Service Center, Charleston, SC.

ACT is committed to develop an active partnership of technology developers, deliverers, and users within regional, state, and federal environmental management communities to establish a testbed for demonstrating, evaluating, and verifying innovative technologies in monitoring sensors, platforms, and software for use in coastal habitats.

ACT, Headquartered at the Chesapeake Biological Laboratory (CBL) at Solomons, Maryland, is a partnership of NOAA with the University of Maryland Center for Environmental Science (UMCES); the School of Oceanography of the University of South Florida (USF) in St. Petersburg; the Skidaway Institute of Oceanography (SkIO) in Savannah, Georgia and the Moss Landing Marine Laboratory (MLML) & the Monterey Bay Aquarium Research Institute (MBARI) in Moss Landing, California.

A Workshop of Developers, Deliverers, and Users of Technologies for Monitoring Coastal Environments: Targeting the Technical Monitoring Needs of Coastal Scientists and Environmental Resource Agencies

BACKGROUND INFORMATION

The increase in human population and activities in coastal watersheds can significantly affect coastal aquatic ecosystems. Over fertilization, contaminant inputs, the exploitation of living resources, and landscape/bayscape modifications can lead to habitat loss, depletion of commercially-valuable stocks, harmful algal blooms, fish kills, introduction of exotic species and other changes that become the concern of both research scientists and environmental resource managers. Both episodic meteorological events and longer term climate changes will compound and cloud documenting the effects of local and regional human alterations on the environment.

Thus scientists, managers, and the technology industry recognize the need to design and implement sound monitoring programs, which need to involve new sensor/platform/telemetry technologies that will provide environmental data sets to document short and long term trends in tracking changes in coastal ecosystems. The potential is enormous and great strides are underway to develop coastal observing systems based on in situ monitoring and real-time data. The acumen of the academic science community in research investigation of oceanographic processes and the entrepreneurial force and talents of the marine technology industry have been major developers and testers of not only sensor technologies, but also their operating systems for monitoring coastal waters. In many instances, partnerships between the academic community and industry to develop and 'beta-test' new technologies have been a major modus operandi in successfully producing credible 'off the shelf' monitoring technologies.

... Scientists, Managers, and the Technology Industry recognize the need to involve new sensor/platform/telemetry technologies... in tracking changes in coastal ecosystems.

Credible performance data on innovative coastal and ocean monitoring technologies are goals shared by many, including:

- Users of technology, particularly researchers and resource management agencies, who need an objective source of reference data to make informed decisions regarding appropriate applications of new technologies.

- ❖ Permitters at local, state, and federal level who must decide on which technologies to allow into use.

- ❖ Marine-based industries and services who need improvement of the short to medium term observations and predictions for maritime conditions.

- ❖ Technology developers in the public and private sector who want their innovations evaluated on a level playing field of objectively-acquired data.

- ❖ Technology investors who must determine the level of risk involved in supporting innovative technology developers.

However, developing such observing systems that will dependably produce needed resolution while containing costs is a major barrier to the goals of 'nowcasting' immediate or long term environmental changes. This need for cost-effective and dependable observing systems that target appropriate resolution needs is particularly important in meeting the regulatory needs of environmental managers and policy makers. Many of the hurdles that hamper advances in developing operational sensor technologies are linked. Technology developers often lack the technical information, skills, tools, and facilities to assess their technologies in situations similar to those their products are designed to address. Potential users of innovative approaches must be persuaded that new technologies perform as well as or better than conventional methods. This is particularly important when considering that the data will be used to support important decisions and strategies such as: protection of human health and the environment, natural resource management, mitigation, enforcement, or litigation. Investors are reluctant to invest until a clear market for the product is defined and the product can achieve some sort of management/regulatory acceptance. Managers and regulators are reluctant to introduce new technologies that are not supported by proven performance data. The result is slow acceptance of technologies that may be able to help governmental management agencies achieve their resource management goals faster, better, and less expensively.

The need for cost-effective and dependable observing systems that target appropriate resolution needs is particularly important in meeting the regulatory needs of environmental managers and policy makers.

What is needed to overcome these barriers to innovation in monitoring technologies is a concerted effort to link and combine the talents and needs of the developers and users -- academic researchers, industrial developers, and environmental quality/resource mangers. A partnership of scientists, managers, and industry could address a host of issues hampering the effective use of current technologies as well as the development and transfer of test technologies to operational monitoring systems. An organization supporting such an alliance of these partners could promote effective monitoring strategies by:

- ❖ Developing, compiling, and communicating useful documentation on

sensor/platform technologies.

- ❖ Facilitating the development and testing of monitoring technologies that meet the span of needs of researchers and local, state, and regional environmental managers.

THE ALLIANCE FOR COASTAL TECHNOLOGIES (ACT)

The Alliance for Coastal Technologies (ACT) was launched by NOAA's Coastal Service Center (CSC) in Charleston, SC and scientific research institutions to foster such a partnership and to bring together the talents to meet the needs of monitoring technology developers and users. The technical needs of coastal resource managers, as well as research scientists, to carry out effective environmental and natural resource monitoring, are the driving force behind ACT. ACT, conceived from a series of CSC-sponsored workshops, is a consortium of research institutions across the country committed to developing an active partnership with both state and regional managers, and private industries who deal with the need for effective use of sensor technologies in monitoring coastal environmental natural resources. To achieve its goals of facilitating partnerships of the developer/user groups of sensor technologies, ACT has established Headquarter Facilities, a Partnership Board of participating research institutions, and a Stakeholders Council of representatives of the developer/user community.

■ ■ ■ *ACT HEADQUARTERS AND THE PARTNERSHIP BOARD*

Headquarters of ACT are located in the Coastal Technologies Laboratory (CTL) at the University of Maryland Center for Environmental Science's (UMCES) Chesapeake Biological Laboratory. Headquarter staff; which consist of the ACT Director, Chief Scientist, and both administrative and technical staff; support national ACT activities. The ACT Director works closely with the NOAA Coastal Services Center, in consort with the ACT Partnership Council, and with the advice and guidance of a Stakeholders Council in carrying out ACT activities.

The ACT Partnership Board, chaired by the ACT Director, is comprised of NOAA representatives and research institutions that have substantive involvement in coastal monitoring technologies and who are also committed to providing research/development facility and staff support capabilities for ACT programs.

Founding ACT research institutions are:

- ➢ the University of Maryland Center for Environmental Science (UMCES)
- ➢ the University of South Florida (USF)
- ➢ the Skidaway Institute of Oceanography (SkIO)
- ➢ the Moss Landing Marine Laboratory (MLML) & the Monterey Bay Aquarium Research Institute (MBARI).

More information on the institutional activities of ACT's Partners may be found on links to their home pages on the ACT web page. As ACT develops, it is expected that a limited number of additional institutions will join the Partnership Board.

■ ■ ■ *THE ACT STAKEHOLDERS COUNCIL*

To promote ACT's mission and functions, it is essential to insure outreach to community, government, academic, and commercial organizations. ACT is in the process of establishing an advisory Stakeholders Council comprising representatives from the coastal resource manager, marine science researcher, and commercial equipment manufacturer communities. The mission of this Stakeholders Council is to foster the interactive flow of ideas and information between the various parties and disciplines that are critical to the success of ACT's technology initiatives. The ACT staff will initiate and maintain visibility and viability through participation in various commercial, scientific, or governmental alliances, partnerships, or focus groups. ACT staff will solicit advice and work with Council members in establishing guidelines that govern the Council's mission, scope, organization, and operating procedures. This ACT Stakeholders Council, working in collaboration with the ACT Director and the Partnership Board, shall bring to ACT the talents, experience, and vision of the broad spectrum of the coastal monitoring community. By real participation in ACT planning and decision making, the ACT Stakeholders Council will insure a true monitoring technology's developer/evaluator/user partnership.

More Information on ACT may be found on the web at: http://www.actonline.ws

ACT 2000 WORKSHOP GOALS

This first ACT-sponsored workshop brought together ACT scientists and a cross section of local, state, regional, and federal environmental resource managers as well as commercial instrument manufacturers of monitoring technologies (see Appendix A.). The goal of the workshop was to help ACT identify and develop both a broad vision with some specific goals as well as a work plan that would address specific key needs of users and developers of sensor technologies in coastal monitoring. In so doing, we also wanted to seek advice as to how ACT could best organize to engage the talents of these user and developer groups so that ACT would really become that "partnership" of technology developers, deliverers, and users within regional, state, and federal environmental management communities.

The workshop provided an open forum for discussion of technical and resource management and regulatory issues of importance to the stakeholders and also covered the following areas:

- Developing a vision to address needs of the resource management community.
- Identifying capabilities and shortcomings of existing technologies.
- Identifying new and emerging technologies and their possible applications.
- Brainstorming monitoring needs for which technologies currently do not exist.

Briefing documents supplied to the attendees prior to the workshop provided examples of potential types of activities that ACT might pursue:

- Providing a sound scientific/technical facility and protocol for moving experimental technologies to the field for rigorous trials that document their cost, performance, suitability, and market potential, and provide timely information to the diverse community of potential end-users.

- Providing a mechanism for efficient technology transfer to "pull" coastal and ocean technologies being developed by universities and the private sector into routine use by the environmental management and research communities at a faster rate.

- Facilitating acceptance and application of innovative technologies by local, state, and federal managers to:
  - Insure quality of science-based decision making
  - Seek technologies that address management issues that represent local through national relevance, and are both compatible and realistic with users' capabilities
  - Provide information, support, and training in new monitoring technologies
  - Identify technologies that meet users' changing needs

- Convening stakeholders who represent diverse viewpoints and backgrounds from business, state and local government, academia, and the nonprofit sector to relate ideas and values to the foremost challenges facing coastal management, data, and information needs for addressing those challenges.

- Developing customized training coupled with interactive expert systems or coaching facilities to guide users through performing procedures, integrating new information streams, and making decisions using new tools.

- Fostering public awareness of the commercial and social benefits of marine observing and forecast systems.

At the workshop, within a series of sector and cross sector breakout groups, the workshop attendees were asked to address the following questions:

- Identify various types of 'needs' (process needs, measurement needs, verification needs)for successful development of monitoring technologies to support monitoring programs.

- What does your developer/user group bring to the table to foster these 'needs'?

- What does your group need from the other groups to insure efficient and effective development of monitoring technologies?

- Identify a small number of needs that the group feels are especially important in developing the operational structure, goals, and priorities of ACT activities.

In plenary sessions the whole group identified and discussed the major ideas developed in the breakout sessions, and developed both broad range recommendations and specific goals to achieve those objectives.

ACT WORKSHOP RECOMMENDATIONS

ACT cannot address all the needs of monitoring technologies. This workshop was structured to identify, characterize, and circumscribe more carefully what might be specific areas of focus for ACT, and to identify particular priority tasks that address that focused mission. As discussion developed, it was obvious that the general goals that the participants thought should guide ACT in articulating its mission and choosing its menu of activities were necessarily interrelated. The following is a summary from the workshop of ideas and recommendations for ACT to consider:

■ ■ ■ *GENERAL ROLES AND PRINCIPLES THAT SHOULD GUIDE ACT IN DEVELOPING ITS MISSION AND ACTIVITIES*

1. ACT should address *documentation.* In discussing what role ACT could best provide to facilitate a real working partnership with the provider/user communities of sensor/sensor support technologies, it is important to understand distinctions between roles that could be labeled: 'validation', 'certification', 'evaluation', and 'documentation':

   - ***'to validate'*** is to grant official sanction, to support and corroborate on a sound and authoritative basis;
   - ***'to certify'*** is to authoritatively attest and/or guarantee meeting of a standard;
   - ***'to evaluate'*** is to determine or fix the value or worth;
   - ***'to document'*** is to provide with factual support for statements, to equip with exact references to authoritative supporting information, to produce with a high proportion of details closely reproducing authentic situations or events

   Rather than the more regulatory roles that focus on operational testing, ACT needs to be a supportive 'honest broker' that works with both the technology developers and different types of users, each having an array of different needs, to develop fair documentation for the uses, capabilities, and expectations of sensor/sensor support technologies.

   ACT should focus on providing 'one stop shopping' for current information needed by all developer/user groups. ACT should address not only instrument specifications and performance, but also their suitability such as operational sensitivity (precision/accuracy), performance, durability, and recommended operating procedures across the range of inshore environmental habitats. ACT could establish some benchmarks for sensors; e.g., suitability for class I, II, and III waters.

   ACT would need to distinguish the differing capabilities required for basic scientific

research, regulatory enforcement, and outreach education. There is a wide range of technology sophistication, and hence cost, that is not always suitable for all scenarios. Technologies should be geared to the level of data precision, accuracy, and reliability required. For example, needs range from the specifics of research programs to management needs (both management decisions and legal concerns), to public information service in outreach education.

ACT needs to consider the spectrum of technologies for coastal monitoring. This spectrum will range from sensors through supporting technologies to platforms.

ACT should report on both established and newly-developed technologies.

ACT must be rigorous but fair in such reporting, working with the industry in providing a sound description, accreditation, and 'best practices'. Such an 'honest broker' role will insure that the instruments are not misused and then blamed for poor performance under unrealistic conditions. ACT also needs to design working protocols that recognize the role of 'beta testing' new instruments. Such testing is often done by industry in partnership with large research institutions. Companies might want to consider also working with ACT partners in early development to test scales of appropriate use over a variety of environmental habitats. Thus, ACT could work with industry in bringing instrumentation to market. ACT would need to recognize the appropriate confidentiality expected as instruments move from beta testing to marketplace.

2. ACT should provide a participating forum among the monitoring technology developers/user groups for effective *communication*. ACT could provide current and reliable market information: a clearinghouse for scientific, operational, and economic information on things germane to management needs for coastal operational use. This information could include 'up front' equipment costs versus 'habitat life', servicing costs, component versus packaged sensor swap outs, and multi-operators' experiences and recommendations. ACT could provide industry with a forum for dialogue about the users' current and perceived future term monitoring needs and applications, performance requirements, and feedback on deployment time/effort and projected estimates of units needed as monitoring programs are planned.

3. ACT could serve as an impartial *proving ground* for new sensors/technologies by improving the interactive coupling between science, industry, and management in conceptualizing, developing, and evaluating applications for sensor/sensor support monitoring technologies. For example, ACT could foster and help arrange pre-commercial/prototype partnering in seeking development funds for new technologies that addresses the nation's needs in coastal monitoring.

4. ACT should *focus inshore* on the problems associated with using sensor and sensor support technologies in the diversity of habitats of coastal environments that can range from offshore

to the freshwater interface. There are perceived holes in the monitoring needs of estuaries that suggest some focus on the boundaries of fresh/seawater influence. Further, in the inshore zone there is a great diversity of user communities with different technology needs. One such concern is the link between remote sensing and in situ measuring. Yet, in so focusing inshore, ACT should capitalize on the strength of oceanographic advances in monitoring technologies.

5. ACT must consider while designing its activities the distinct difference in the needs of scientific and operational monitoring systems, and develop appropriate supportive roles.

6. ACT needs to give some priority to "biosensors", i.e. biological monitoring problems dealing with biofouling, developing molecular probes, optical sensors, and acoustic sensors. One of the needs of the management community is in undertaking measurements of water quality (e.g., nutrients, dissolved oxygen, temperature, turbidity, and potential chemical toxins) and relate this to resource management goals such as dealing with harmful algal bloom events and stock assessment of commercial fisheries. ACT needs to facilitate the development of "biosensor" technologies to achieve those management goals.

7. ACT needs to 'think global' in providing a unique service geared to American user groups, recognizing the U.S. as part of a world industry and the common interests of the scientific and monitoring world communities.

■ ■ ■ *TALENTS AND NEEDS THAT DEVELOPER AND USER SECTORS OF THE SENSOR MONITORING COMMUNITY BRING TO AN ACT PARTNERSHIP*

In undertaking an ACT Partnership and developing viable ACT projects guided by the general roles outlined above, the developers and users of monitoring sensor/sensor support technologies in industry, research institutions, and environmental resource management communities have special needs and bring complimentary talents to success:

➔ *Mutual Commitment*. Foremost, all must commit their talents to the partnership, recognizing and accepting each others differing needs and varying roles that together can advance the suitability and capability of monitoring technologies. Technology developers and ACT Partners must be willing to develop a working relationship that assures open information exchange for use in developing documentation and test procedures that do not compromise early development activities.

➔ *Knowledge.* Industrial and research institutions bring talents in developing and testing for both new and existing instrumentation as needed by the user communities. The user monitoring communities can in turn facilitate interaction with those responsible for 'everyday' operational deployment of the technologies in management monitoring programs.

➔ *Technical Support*. The management community can support the transition from research, both in industry and in the universities, to operational modes of monitoring technology. Given clear objectives, it can provide the funding to implement and help evaluate operational monitoring systems.

➔ *Rewards*. ACT can facilitate a 'win-win' reward system:

- industry gains access to information on market needs for its planning and technology development as well as for beta testing and evaluation activities with both known and trusted partners;
- research institutions can provide industry with its intellectual base while gaining contract support for pursuing factual development of conceptual ideas;
- environmental managers get attention paid to their specific needs while providing the diversity of habitats for implementing tests of operational monitoring systems.

ACT needs to encourage that individual's research institutions be recognized, and award those individuals for their sensor technology contributions.

■ ■ ■ *SUGGESTED SPECIFIC PRIORITY ACTIVITIES FOR ACT:*

1. ACT should organize fora on specific issues addressing the needs/problems in sensor technologies for use in environmental monitoring. The following were identified as potential priority issues for such fora:

    1.1 the distinction between research and operational technologies.

    1.2 the biofouling issue... Assessing the through-life costs of technologies with respect to biofouling (e.g., 'low maintenance' versus 'disposable sensors') sensors that have required accuracy yet are able to stand up in court.

    1.3 short term versus long term monitoring issues; Helping to understand and develop information on differences in technology needs on different temporal and spatial scale needs.

    1.4 rigorous needs assessment within management community.

2. ACT should help in planning sensor technology capabilities for networking of monitoring sites. ACT might use coalitions of organizations such as NAML and its LabNet initiative that have the capability of networking the data bases at its 115 coastal members and the Marine Sanctuaries to take advantage of spatial geographical coverage and habitat diversity for testbed activities.

3. ACT should define a beta testing protocol within the context of ACT's agenda.

■ ■ ■ *THE ORGANIZATION OF ACT:*

The ACT Director and Chief Scientist will need a mixture of both scientific and technical, as well as social skills, in successfully leading ACT. They will need to work with the ACT Partners and Stakeholders in integrating and co-ordinating ACT activities.

The ACT Director should work closely with ACT Partners and Stakeholders, should have experience in the technology development industry, and have a sound business sense. She/he should also have a proven record of operating within the federal funding structure. The successful candidate would insure that ACT is not a closed shop, but would offer contact with the broad spectrum of the technology development community and facilitate a consensus building.

The Chief Scientist, who should also work with the ACT Partners through the ACT Director, must be technically proficient both in science and technology, and have sound experience with monitoring technologies and monitoring programs. She/he should have a sound understanding of biological monitoring needs and probably would best come from the academic culture.

ACT headquarters will also need: staff to provide base service and coordinate Partner activities in testbed activities; communications expertise to support computer web page/publication activities; and expertise in electronic technologies to work with developers/users in ACT testbed activities.
The Partnership Board should:

- include NOAA CSC leaders
- supply added value in expertise and facilities to ACT planning and project activities
- foster the distributed capabilities and vision of ACT
- ensure that the Partners identify representatives that are able to commit their institution in formulating and implementing ACT activities.

The Stakeholders Council is a place where scientists, industry, and management folk interface and engage. Some characteristics that would serve the Stakeholders Council:

- finite size but focused with tenacity and resolve
- be expected to show commitment to the success of ACT
- have terms of appointment to the Council
- help insure that ACT is service-oriented, i.e., service and cooperation underlie focused activities
- might also include representatives of coastal environmental-oriented organizations such as the Estuarine Research Federation (ERF), Sea Grant, the American Association for Limnology and Oceanography (ASLO), Coastal States Organization (CSO), and the Marine Technology Society.

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Special thanks to Mrs. Christine Ryan, ACT Administrative Assistant, for all of her work on the logistics for the workshop, and to Ms. Joy Bartholomew, Executive Director of Estuarine Research Federation (ERF), for serving as Facilitator for the workshop.

The workshop attendees are thanked for their services to our community in dedicating their time talents, and great effort in contributing to advancing the quality of environmental monitoring technologies.

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4 December, 2000

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ACT 2000 Workshop Participants

Photograph taken at CBL outside of the Nice Hall Building on Friday, October 20, 2000

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