

December 2, 2008

Dr. Richard Spinrad
Assistant Administrator
Office of Oceanic and Atmospheric and Research
National Oceanic and Atmospheric Administration
1315 East West Highway
Silver Spring, Maryland 20910

Dear Dr. Spinrad:

Attached find a summary report and completed review forms for the five independent reviews of the Atlantic Oceanographic and Meteorological Laboratory (AOML), in Miami, Florida. These review comments were compiled as a result of our site visit, interviews with leadership, senior staff and support staff, and independent research we have conducted on the programs supported by the Laboratory. On behalf of the review committee, we thank you for the opportunity to provide input to OAR regarding the quality, effectiveness and responsiveness of the Laboratory. The laboratory is a critical national resource and the nation depends on its research to support critical mandates related to hurricane protection, emerging climate impacts, ecosystem protection and technology development. Recent developments including new resources supporting hurricane forecasting, the emerging National Climate Service and other issues provide important new opportunities to re-invigorate the program at AOML.

The review team would be please to discuss these conclusions with you and laboratory management further, at your convenience.

Sincerely,

Steven Murawski, Ph.D.
Director of Scientific Programs and Chief Science Advisor
NOAA Fisheries Service

**External Review
Of the
Atlantic Oceanographic and Meteorological Laboratory
Miami, Florida**

**Submitted To The
Office of Oceanic and Atmospheric Research
National Oceanic and Atmospheric Administration**

December 2, 2008

Summary

The external review panel met for three days on March 18, 19, and 20, 2008. Per the charge given to the review group, the team evaluated the quality, relevance, and performance of research conducted at Atlantic Oceanographic and Meteorological Laboratory (AOML) to help the National Oceanic and Atmospheric Administration strategically position the laboratory in its planning of its future science. The review is intended to ensure that AOML research is linked to the National Oceanic and Atmospheric Administration (NOAA) Strategic Plan, is relevant to NOAA Research mission and priorities, and is consistent with NOAA planning, programming, and budgeting. Each reviewer independently prepared their written assessments; the Chair, a federal employee, summarized the individual assessments in the report below. The Chair did not analyze individual comments or seek a consensus of the reviewers.

This review covered the research themes and related topics: 1) Hurricane (Tropical Cyclone Intensity Change, Tropical Cyclone Structure and Precipitation, Tropical Cyclone Tracks, and Tropical Cyclone Frequency and Intensity); 2) Oceans and Climate (Climate Observing Systems, Atlantic Circulation and Fluxes, Atlantic Meridonal Overturning Circulation, Western Hemisphere Warm Pool and CO₂ ; 3) Ecosystem (Florida Coastal Ecosystems, Corals).

The five independent interviews provide some consistent themes as well as a variety of unique perspectives on hurricane research, climate and oceans, marine chemistry/ecosystems, and technology foci of AOML. The review team heard a number of consistent messages from the various levels of the staff that are highlighted in the individual contributions. Following provides an overview of comments provided separately by each reviewer:

Reviewer	Primary Topic	Secondary Topic	Additional Comments?
Robert Houze	Hurricanes	Ecosystems (microbiology)	Yes - ships
Ramesh Kakar	Hurricanes		Yes – aircraft, HFIP
Douglas Luther	Oceans-Climate		Yes – Ships, PPBES, visibility, recruitment
James Miller	Oceans-Climate		Yes – ships, PPBES, visiting scientists
Steven Murawski	Ecosystems	Oceans-Climate	Yes – ships, hurricanes

Hurricane (Tropical Cyclone Intensity Change, Tropical Cyclone Structure and Precipitation, Tropical Cyclone Tracks, and Tropical Cyclone Frequency and Intensity): The two primary hurricane program reviewers (Houze and Kakar) emphasized the transitional nature of the hurricane research program at AOML. Clearly, the scientific reputation of the hurricane research staff (particularly in theory development) was, overall, stronger in the past, and the Laboratory has struggled with sustaining its national and world-wide reputation. There is a concern that the unique historical competency of the Laboratory in hurricane observations might be lost if efforts to rebuild the staff expertise in modeling are done at the expense of the observations program. There are a number of new promising hires that can, along with additional strategic hires, allow the laboratory to regain its world-class reputation. Likewise, reviewers emphasized building greater collaborative relations with the University of Miami and the larger hurricane community (both in other Agencies and the academic community). Both primary reviewers mentioned resource limitations as a substantial cause of some of the shortcomings, and new investments in HFIP should allow some issues to be addressed.

Of particular concern to the research community is the allocation of P3 aircraft to operational hurricane missions vs. research missions. Given the impending addition of a third P3 to the NOAA aircraft stable, this could potentially alleviate some of these pressures. NOAA should also discuss with the Air Force Reserve the possibility of their taking on proportionally more of the operational mission for hurricanes (at least in the medium-term) thereby freeing up critical research aircraft time. As well, promising research on unmanned aerial vehicles could potentially provide additional research flight hour capability (albeit with a simpler research focus for any one mission). NOAA should be careful in the development of its UAS program to involve the research community to assure that the observations (again an historical strength of the laboratory) are well vetted with the larger hurricane community. Given the new dollars flowing into HFIP, this is of considerable importance.

Over and above the comments of the two principal reviewers, the team emphasizes the importance of storm surge modeling as a factor in any serious hurricane research program. For example, recent surge predictions for Hurricane Ike were significantly at odds with the actual surge at Galveston (approximately 50% lower than forecasted: 11tv.com/local/ike.storm.surge.2.816898.html). While AOML is not directly focusing on this mission, it needs to consider how ocean physics and hurricane intensity/track interrelate with surge and this can only be done in an integrated way. Similarly, no one at AOML mentioned the importance of social science research as part of a re-invigorated hurricane research program. A modern multidisciplinary approach to hurricanes requires an end-to-end perspective hopefully resulting in fewer deaths and injuries due to these massive storms.

Recommendations:

1. NOAA modeling centers must share model code in order to engage the research community in the development of better hurricane forecasts.

2. AOML hurricane OSSE initiative should be encouraged and it should be required that this plan be coordinated and synergized with the ongoing OSSE activities of the JSCDA.
3. AOML needs to carefully consider where in the spectrum of hurricane research its mission should fall. A number of other institutions provide state-of-the art modeling expertise, but the historical strength of AOML hurricane research has been in observations, which it is uniquely qualified to provide.
4. OAR and AOML OAR and laboratory management should work with the EMC management to make it possible for HRD and EMC to share the model code on a continuing basis to accelerate the model development efforts.
5. HRD should be provided with additional flight hours annually solely for the purpose of carrying out focused research programs.
6. HRD needs to continue to improve its publication record and recruit staff who will be intellectual leaders that contribute usefully to the literature on tropical cyclones.
7. HRD should rebuild its connection with the external community to carry out the aircraft experiments needed to advance hurricane knowledge.

Oceans and Climate (Climate Observing Systems, Atlantic Circulation and Fluxes, Atlantic Meridonal Overturning Circulation, Western Hemisphere Warm Pool and CO₂): Both primary reviewers (Miller, Luther) found the quality and productivity of the Ocean-Climate research enterprise at AOML to be superior, as judged by publications, awards and recognized standing in the field. Both commented on the productivity of researchers, the relevance of the research both to global and national problems and to local to regional issues faced by NOAA and external partners. One reviewer commented on the relevancy of the Ocean-Climate to NOAA's Strategic Plan for research, and its mission goal priorities for climate. Both reviewers noted that a critical strength of the Lab in this endeavor is the observational capabilities, which are producing important products used in climate modeling and for tropical predictions of interest in weather forecasting. There was an interest among reviewers in expanding the ocean-atmospheric coupled modeling capabilities to take advantage and better interpret the observations being obtained (at great current costs), and for better optimizing the collection of such observations (e.g., through OSSEs). Sustaining long term ocean observations will become ever more expensive and the limits of this are being tested with the recent run up in fuel costs. Therefore there is every incentive for the Lab to look carefully at data series and observation frequency.

Recommendations:

1. AOML should facilitate and enable climate modelers to be more engaged with the scientists responsible for observations so that two-way feedback can be enhanced to ensure that modelers fully utilize observations to validate and improve their models and that field scientists are providing the optimal set of observations for the model efforts.

2. AOML should continue to emphasize strengths that have traditionally been in observational work but add complementary analysis and modeling efforts to better connect its work with the larger research community.
3. AOML should articulate in a new AOML strategic plan the scope of key projects, particularly related to long-term climate system observing and the new emphasis on modeling to maximize future contributions of AOML to the ocean and climate community.
4. AOML should expand the visiting scientist program as a way to improve modeling activities at AOML. A good way to start would be to make sure all of the potentially important connections exist with RSMAS scientists across the street.
5. AOML should begin planning for succession. A few senior level hires are needed to ensure that new division leaders are in place and overlap with present directors of the Ocean Chemistry and Physical Oceanography groups before they step down.
6. AOML should continue to emphasize strengths that have traditionally been in observational work but add complementary analysis and modeling efforts to better connect its work with the larger research community.
7. AOML leadership should consider partnering with operational NOAA elements and other agencies to evaluate impacts on ocean climate on natural resources, coastal communities and other issues of relevance to people.
8. AOML should document why particular programs are considered to be among the most important and/or the most important cost-effective to the mission. These might naturally be part of the AOML strategic plan.
9. The articulation and relevance of PO.'s programs to NOAA's mission should be made available to the public.
10. NOAA should allocate sufficient resources to analyzing data as opposed to simply collecting it.

Ecosystem (Florida Coastal Ecosystems, Corals): The single primary reviewer (Murawski) noted that the ecosystem research enterprise within AOML is a highly diverse set of programs doing generally very high quality research consistent with NOAA's 5-year research plan. An ecosystem-oriented researcher (ocean chemistry) has the highest H' index in the laboratory and there are a number of researchers of similar stature. The ecosystem portfolio is so broad that there is an ongoing issue of balancing novel research with fee-for-service functions, primarily used to pay the bills. AOML needs to carefully consider breadth vs. depth issues in its ecosystem portfolio. Several recommendations on the ecosystem side include the importance of hiring a replacement multi-disciplinary researcher to enhance connections among ocean disciplines in the Laboratory, and to understudy for the eventual retirement of the Ecosystems Division Chief. As well, the ecosystems portfolio would benefit from greater collaborations with the co-located NMFS laboratories and NOS elements in the vicinity of the Lab. The general lack of collaborative research in the Gulf of Mexico among NOAA research elements is an obvious area in which to consider greater collaboration (particularly in light of NOAA's emphasis on regional collaborations).

Recommendations:

1. Laboratory management should set some bounds on the degree to which specific applications are pursued vs. research and development activities. It should be a high priority of the Division to do a top-to-bottom review of its internal priorities and long-term focus consistent with NOAA's priorities.
2. The lab needs to carefully manage its ecosystem portfolio so as not to be subsumed by service functions to these other organizations resulting in a predominant service portfolio.
3. As staff retire, AOML should revisit the research portfolio rather than simply replace outgoing expertise one-for-one.
4. AOML needs to assess whether the presence of reimbursable research activities are consistent with its long term plans and priorities, especially if they require new hires to sustain in the future.
5. AOML and the NMFS facility should develop a strategic outlook and plan for cooperative ecosystem studies.
6. AOML needs to be a national and global leader in ocean acidification and geoengineering solutions to the CO₂ issues, taking advantage of its staff expertise and strategic relationships (e.g., among global, national and the network of OAR researchers). Given its proximity to other line offices with complimentary expertise (NOS, NMFS) such research should be conducted to evaluate not only ocean chemistry issues but ecological impacts as well.

Ship Support for Ocean Missions: A significant recurring theme heard in our interviews and confirmed by examination of ship schedules is the lack of sufficient ship support supporting AOML's ocean missions. Numerous staff and senior scientists commented in the material condition of the ships, their equipment, unreliability of the schedules and highly competitive atmosphere regarding the use of the one Class 1 NOAA ship – *Ron Brown*. Of course AOML and OAR do not maintain the ships or are completely responsible for its mission allocations. Apparently NOAA has addressed some of the maintenance issues on the ship this summer, but the issue persists about long deployments, maintenance and a high levels of mission subscription in both the Atlantic and Pacific. The review panel has no specific recommendations other than to urge that sufficient support for the ocean going mission is required if the ocean climate and ecosystem missions are considered a priority by NOAA. Alternatives to the use of the over-subscribed NOAA fleet include additional chartering time aboard UNOLS vessels, cooperative agreements with other nations and piggybacking with other NOAA line offices using other (more coastal) vessels in the fleet. Leadership in AOML and OAR should explore these issues to better utilize sea days aboard the full fleet.

Individual comments emphasize the importance of being competitive with academia in terms of research conditions, support and collaborative environments. While there are limitations imposed by federal service, the unique focus of the laboratory on observation capabilities is a consistent message across all of the domains reviewed. All reviewers emphasized that this is a uniquely governmental role, and the lab should play to its strengths as it moves forward in these important efforts. Reviewers offered a number of

suggestions to improve the review process in the future but were overall satisfied with the process followed.

Again, we very much appreciate the candor, cooperative spirit of laboratory staff and leadership, as well as the commitment to preserve the Laboratory's strengths as well as to address issues for improvement. AOML is a vital national resource and comments offered by the reviewers are provided to help strengthen and preserve its unique role.

Recommendations:

1. The research fleet of NOAA must be better maintained and regain reliability if AOML is going to be able to achieve its research mission. One reviewer thought this is the most important issue that emerged in the AOML review. If the lab is going to support an ocean observations program at the Atlantic basin to local scales reliable access to ship time, either aboard NOAA ships with time allocated directly to AOML, allocated to its sister agencies (e.g., NOS, NMFS), charters aboard UNOLS and other ships, or in conjunction with other entities (e.g., NSF).

The Lab Review Process Recommendations:

1. It would be helpful to shift some of the time spent on scientific presentations to smaller group discussions of critical issues. More of the scientific presentations could provide overviews and a bit less detail. There were small group discussions with individual laboratory leaders toward the end of the process that were very helpful. These discussions, however, reduced the amount of time the review team had for discussion among its own members.
2. Provide more face time with division directors and PIs.
3. More time should be scheduled for meetings with individual research staff members.
4. More time is needed for the committee to deliberate alone to clear up misperceptions and to coordinate follow-on inquiries with the Director and science staff.

Other Recommendations:

1. One of the best ways to improve the visibility of AOML is by improving its website. The Team strongly recommends that professional web designer be brought in for this, and that this web designer does a considerable amount of beta testing with the external user community.