VII. CONCURRENT WORKSHOPS

The Concurrent Workshops all addressed the larger theme of "Models that Work and Lessons Learned." Two sessions were held, each having four concurrent workshops representing Academia, Student Life, and the Private and Public Sectors. At each session, a group of panelists spoke on a specific topic within the theme. A moderated question and answer period followed.

ACADEMIA

Panel A—Achieving Educational and Occupational Goals

Moderators: Dr. Edward Thomas, Auburn University
Ms. Nikola Garber, National Sea Grant College Program, NOAA

Panelists: Dr. William Bonner, University Corporation for Atmospheric Research
Dr. Bradford Brown, NMFS, NOAA
Dr. Gleyn Bledsoe, Land Grant and Outreach, Northwest Indian College
Dr. Marin Robinson, Northern Arizona University
Ms. Letise Houser, Brown University
Dr. Mark Hardy, Jackson State University

A Reminder of NOAA's Goals

Dr. Bradford Brown opened the session, stating again the three-fold goal of NOAA:

- To increase the number of Black, Hispanic, and Native Americans in the scientific professions of NOAA's agencies.
- To enlarge the pool of qualified minority applicants to these positions.
- To support Minority-Serving Institutions in preparing students to enter the scientific profession.

Minority Institutions Must Initiate Partnerships

The key to achieving the above is partnerships. Through partnering, NOAA had a major role in helping to build the current capacity of majority institutions, much of which was done by direct financial support. While Dr. Brown has continually urged NOAA to seek out partners from minority institutions, he has noticed that most of the successful established partnerships were initiated by the majority institution. Institutions seeking to serve minorities must aggressively approach the issue of partnering with NOAA.

Working Programs for "The Forgotten Minority"—Native Americans

Dr. Gleyn Bledsoe reminded the audience that environmental sciences, particularly marine and oceanic sciences, have historically been critical for Native Americans since all tribes were tied to the land. The American Indian Higher Education Council put together a marine research program and now seeks partnerships with NOAA and other federal agencies for an environmental program.

Dr. Marin Robinson, who teaches at Northern Arizona University (NAU), a MSI with approximately 12% Native American student population, named some of the programs developed to support Native Americans' education in the scientific professions. She writes:

"The National Institutes of Health (NIH) funds an initiative to prepare minority undergraduates for entrance into medical school. The program involves research opportunities for targeted undergraduates as well as Supplementary Instruction sessions in the introductory sciences (General Chemistry, Organic Chemistry, Biochemistry, and Biology). Another science initiative at NAU includes a newly-funded *Bridges* program, which targets students from Diné College (formerly Navajo Community College) to conduct research in chemistry and biology at NAU the summer before they transfer to NAU. The program allows faculty to visit the Diné Campus and conduct workshops for students planning to participate in the program. NAU also is the home of ITEP, the Institute for Tribal Environmental Professions. ITEP was created in 1992, in cooperation with USEPA, to act as a catalyst among tribal governments, research and technical resources at NAU, various federal, state and local governments, and the private sector, in support of the environmental protection of Native American natural resources. Other programs related to the environment at NAU include the Merriam-Powell Center for Environmental Research, which focuses on long-range studies of sustainability on the Colorado Plateau, and the Center for Sustainable Environments, designed to coordinate programs across campus related to environmental issues. Last year, NAU added a Masters of Science degree to its Environmental Sciences program and projects an enrollment of 12 master's students by next fall."

Promoting Marine Science Programs at Land-locked Universities

Several participants mentioned the difficulty of promoting marine science programs at universities that are landlocked. This particularly affects MSIs because many MSIs are not located along the coast. Several speakers advocated that these programs needed to be promoted, with special attention paid to the research trips built into the curriculum.

Changing the Intellectual Infrastructure of Universities

Most of the questions in the follow up session involved required courses in math and science, e.g. "Do I have to take organic chemistry?" Many students expressed their frustration at courses not being directed towards their career goals, not demonstrating applied practical knowledge, and not reaching out towards different learning styles. All of the professors present agreed that these courses were important. These courses teach students how to organize and process complex information, how to assess importance, and how to construct a disciplined thought process. In short, the very rigor of these courses is important to prepare students for the rigors, and the opportunities, of the scientific professions. As Dr. Bonner said, "Marine biologists are a dime a dozen." But there is always need for marine biologists who are adept at serious math and science. In addition, the scientific field is a fluid one; scientific and technological knowledge constantly changes. A well-educated scientist can keep up with these changes.

Yet for all this, most professors remarked on how little teacher training they received; some professors acknowledged that they were not good teachers because they had never received any teacher training. In fact, teaching training was often considered by universities to be wasteful, only useful for those graduate students who were struggling in their course work. Preparing for good teaching, ironically, is often antithetical to preparing for good research.

The intellectual infrastructure of the university needs to change. Active research needs to be balanced with active, progressive, teaching. The combination of these two can keep students energized and focused, aware of both the rigor of research and the practical applications of it. This approach also allows for courses to retain their depth and difficulty while becoming more accessible for those students who may not be well prepared. A teaching style that does not consider students' needs simply reinstates the status quo—those students, often minorities, who have not benefitted from a strong secondary education, continue to be "second class citizens" in the university. Universities must reach out to these students, and, in reaching out, prepare students thoroughly, even if this means recognizing that for many minority students a five-year baccalaureate program may be critical.

Panel B—Investing in Building Capacity

Moderators: Dr. Larry Robinson, Florida A&M University
Ms. Margaret McBride, Chesapeake Bay Program, NOAA
Panelists: Dr. Joseph Okoh, University of Maryland Eastern Shore
Dr. Abdul Mohamed, Jackson State University
Dr. Michael Sissenwine, Northeast Fisheries Science Center, NMFS, NOAA
Mr. Kurt Shinkle, National Geodetic Survey, NOAA
Dr. Arthur Allen, University of Maryland Eastern Shore
Dr. Robert Stewart, Texas A&M University

A Brief Overview

Dr. Robinson began by mentioning that Dr. Allen had been called away, and reminded the participants of how important it is to build capacity, particularly within minority institutions. The roots of this Conference extend back to 1997 when a consortium of schools met with NOAA regarding the concern that there wasn't enough capacity within these institutions to serve NOAA's employment needs. That meeting led to NOAA's direct investment in minority-serving institutions to help build the infrastructure needed to do active oceanic and atmospheric research and educate students in the oceanic and atmospheric sciences. In the best situation, as Dr. Sissenwine said, building capacity is a win-win situation. The minority community and its academic institutions are expanded, able to fully participate in marine and atmospheric science, and the capacity of NOAA and its Line Offices is expanded, able to fully diversify its scientific workforce.

Philosophies to Consider in Building Capacity

Dr. Sissenwine offered his perspective as the Director of the Northeast Fisheries Science Center (NEFSC), which is a relatively small organization compared to NASA or NSF. Most of NEFSC's resources are dedicated to on-going operational activities; there is little grant money available. The capacity building strategies, then, must be intuitive, oriented towards small, on-going successes.

- **Managers Must Be Responsible For Success**
  Managers cannot let EEO committees do all the work towards diversity. Managers themselves must be committed and responsible for hiring, sustaining, and promoting under-represented people.

- **Great Successes Are Built On Many Smaller Successes**
  Not every plan needs to be grand in scope; in fact, small successes do add up to sustained success. For instance, the practice of recruiting for student positions in HBMSCUs has been quite effective. Looking back over the 25-year history of this practice, some of the minority students NEFSC hired are now people in prominent and powerful positions.

- **Be Creative, Look For Opportunities Everywhere**
  Opportunities abound if we look outside the box. For instance, a few years ago NEFSC planned an international conference on sea exploration. The conference was held in Baltimore, and NEFSC made a special effort to organize a pre-conference to introduce minority scientists from the Baltimore area to these international scientists. Tremendous contacts were made without expending a lot of money, just a bit of ingenuity. Similarly, we offer daylong research trips on our offshore research vessels for students from smaller institutions. These trips give students valuable exposure to scientists and research.

- **Have Modest Expectations**
  Most people are not superstars. We limit our chances for true change when we expect each minority student and every partnership with an MSI to be highly successful. Most people are average, whether they come from Jackson State University or Harvard, and that's fine. Take a chance on someone, on a partnership. Provide them the support they need to live up to their personal potential.

Capacity Building at the National Geodetic Survey

Like NEFSC, the National Geodetic Survey (NGS) is a smaller part of NOAA with a limited budget and no grant resources. Nonetheless, it works towards capacity building on several different levels, and in each case, NGS benefits by connecting with more people and entering more data into the National Spatial Reference System. (1) Through direct capacity building with San Diego State University, NGS trained students to use remote data sensing and rigorous metric measurement equipment. This training allows students to participate in the Tijuana River Basin Project. (2) Through the Cooperative CORS (Continuously Operating Reference Station) Program, upon request, NGS will help people set up their own GPS (Global Positioning Satellite)

reference station. NGS will provide the expertise, help to acquire the equipment, and run a central web site for access to data. (3) In the State Advisor Program, 22 states in the country have a NGS advisor assigned, whose job it is to help build capacity by dealing with questions of position and elevation. For instance, NGS helps teachers integrate science into lesson plans. This program is free for the asking.

Tremendous Infrastructure, But Few Students

Dr. Robert Stewart, a professor at Texas A&M University, spoke on the difficulty of finding any U.S. students, much less students from under-represented groups. Texas A&M is a large research university, well funded and well staffed with faculty. But it is "spectacularly unsuccessful in recruiting minorities." There are several reasons for this.

- **Most Students, Minority and Non-Minority, Choose Medicine**
  The vast majority of students in the sciences want to become doctors; the rest overwhelmingly are going into computer science or business. Out of Texas A&M's 44,000 students, only 900 are in the geosciences. Most of these students are international students from the People's Republic of China, Japan, and Korea.

- **A De-Emphasis on Geoscience**
  In the State of Texas, geoscience is no longer required past middle school, making it hard to acquire an interest in a subject that is not taught.

- **Legal Issues**
  In Texas and many other states, it is illegal to put together a special program to recruit, educate, or maintain minority students. This is the effect of the Hopwood decision in the federal district court. Other fields, particularly medicine and computer sciences, have more money to recruit minorities without "targeting" them; the geosciences simply can't compete.

- **Federal Monies Go to Top-End, Majority Universities**
  Most of the funding continues to go to the elite, majority institutions. One of the effects of this is to allow scientists more research time. At a majority institution, scientists may only have to teach one course per semester or per year, whereas at a minority institution, that same scientist might have to teach three courses per semester. Clearly, the opportunity to do research is limited by the amount of teaching required. Minority students deserve to have teachers who are actively engaged in research, since those same teachers become the role models for the career professions.

Two Ways to Strengthen Recruitment

- **Target Minority Students at the High School Level**
  If minority students, particularly African-American students, are in short supply at the college level, NOAA and the institutions that serve under-represented students need to reach out to these same students at the high school level. We must encourage students who do well to come into the geosciences.

- **Increase NOAA's Publicity**
  Everyone is aware of what NASA is doing. NASA has a publicity campaign to make sure there's a sound bite and a satellite picture ready for the TV news whenever weather news occurs. NOAA needs a comparable program to encourage students to come into the geosciences. NOAA needs to develop spokespersons, like the late Jacques Cousteau who did so much for oceanography, to talk intelligently and informatively about the work it does. The geosciences have fascinating stories to tell. Some of these are being told to middle-school students and their teachers through a web site called Ocean World (http://oceanworld.tamu.edu). Making sure all young people know about the wonderful world of geosciences is the first step to having them become scientists themselves.

PRIVATE SECTOR

Panel A—Building Mutually Beneficial Partnerships

Moderators: Ms. Pamela Neal, Sarkeys Energy Center, Oklahoma University
Mr. Robert Stockman, OFA, NOAA
Panelists: Ms. Jennifer Carfagno, The Weather Channel
Ms. Cathy Fore, Oak Ridge MEITP, Dept. of Energy
Ms. DeLois Cutter, President, Tal-Cut, Inc.
Dr. Edward Johnson, National Weather Service, NOAA
Ms. DeJonnette Grantham-King, Advance Environmental Consultant, Inc.

The Responsibility of Partnerships

Mr. Robert Stockman opened the discussion by emphasizing the word "partnership." Partnerships require the mutual sharing of interests; each party must benefit. The Minority-Serving Institutions, their graduates, and the private sector entities must pursue common goals in establishing a partnership. It is crucial to recognize this partnership with private industry because the government has limited capacity. NOAA is a relatively small organization; it can only hire a certain number of scientists. Much of the work of the federal government is already done by private contractors; in fact, the policy of the U.S. Government is to explicitly aid growth in the private sector. Dr. Ed Johnson reinforced this idea by giving an example from National Weather Service. NWS provides weather information to everyone for little or no cost. This allows a growth in the private industry—competing television meteorologists, for instance. And beyond television, a number of people consult with private industries to analyze and predict weather patterns and their effect on goods and services. This is a high growth area. In short, the private sector is where most of the jobs are, and increasing diversity requires that MSIs and HBCUs seek out and maintain partnerships with private industry.

The Weather Channel: Partnerships for Successful Business

Ms. Jen Carfagno works for The Weather Channel. She talks about partnerships as an extension of successful business practice. The Weather Channel, for instance, has expanded across the U.S. and into Latin America. It has a Portuguese and a Spanish on-air network, as well as web-sites. To meet the needs of its diverse customer base, it has been expanding the diversity of its workforce. To secure success for the future, the Weather Channel has decided to play a significant role in attracting and retaining people from under-represented groups to the atmospheric sciences. So, The Weather Channel has placed a high priority on building partnerships that help it increase representation— both within the company and in the field. Here are some of these ways:

- The Weather Channel sponsors the American Meteorological Society (AMS) Minority Scholarship.
- It sponsors a summer internship for under-represented students.
- In 2001, Penn State had its first annual Weather Camp, designed for middle-high school students of under-represented groups. The Weather Channel sponsored scholarships for a number of students to attend and participate at the camp, teaching students to make on-camera videos.
- The Weather Channel also partners with the College of Earth and Mineral Sciences at Penn State to actively recruit students from under-represented groups.
- Two senior vice presidents at the company make personal phone calls to these prospective students accepted into the College of Earth and Mineral Sciences at Penn State. They offer encouragement and answer questions about the job market for graduates of the atmospheric sciences.
- The Weather Channel representatives attended conferences, like this one, to promote the advancement of opportunities in the atmospheric sciences.
- The Weather Channel people actively participate in the AMS Board on Women and Minorities and, on a less structured basis, many of the women meteorologists at The Weather Channel act as mentors to other women interested in meteorology.

The Weather Channel, as a whole, is taking steps to increase representation in all departments. Ms. Carfagno ended by talking about the difference between diverse and well represented. Successful, sustained diversity in employment requires each group to be well represented.

Three Government Contractors: Tal-Cut Company, BWXT Y12 LLC, and Advanced Environmental Consultants, Inc.

Tal-Cut Company

Ms. DeLois Cutter, the President of Tal-Cut, which specializes in information technology and engineering services, spoke of being able to expand partnerships as the company grows larger. Tal-Cut was incorporated in Ohio and has several partnerships with high schools in Ohio. Now that it has an office in Mississippi, Ms. Cutter said, “My company would like to establish partnerships with not only NOAA but also Jackson State University, the City of Jackson, the State of Mississippi, and with any student of Jackson State University.”

BWXT Y12 LLC

Ms. Cathy Fore spoke about BWXTY12LLC, which is a merger between BWX technologies and Bechtel National. Three years ago, Ms. Fore was asked to develop a new business program centered around Minority Education Institutions. In doing so, she learned several valuable lessons about partnering with MSIs. More results are available on the company's web site: http://www1.y12.org/meitp

- **The University Must Be Knowledgeable About Partnerships**

Successful partnerships between private industry and academia come when the institution has not only a good research facility, but also a strong business sense. Does it understand the difference between a grant and a subcontract? What experience has the institution had with the business world? MSIs must take responsibility for becoming business savvy when they wish to form and sustain partnerships.

- **Form a Relationship with the Entire University**

It may be the engineering department that is critical to your business, but access, information, and change will come more swiftly if the entire university is recognized. Doing so allows single point contact—directly contacting the President of the Institution to expedite arrangements.

- **Consider a Consortium of Universities**

The State of Tennessee, where Ms. Fore lives, has six HBCUs, each with different strengths. "We put forth a strategy to create a technology-focused consortium of these six schools under the umbrella of the state economic development plan." Each school was consulted and joined in this cooperative venture, the first of its kind.

- **Establish a Mentor-Protégée Agreement**

Within the Department of Energy, these agreements are primarily with small businesses, the program was changed to include MSIs. BWXTY12LLC recently established a protégée-agreement with Tennessee State University in Nashville, helping TSU be more technologically capable in the global marketplace. For example, in TSU's College of Engineering, they want to create a Ph.D program in manufacturing. This will ultimately supply private industry with vitally trained students.

- **Focus on Emerging Technologies**

There are bigger rewards in concentrating on emerging trends in technology, when establishing partnerships. Pay attention to those aspects of research that have the potential to change society.

- **Advanced Environmental Consultants, Inc.**

Ms. DeJonnette Grantham-King owns Advanced Environmental Consultants, Inc, which is a minority- and woman-owned business. AEC provides a wide array of various technical services; for instance, AEC assesses and abates buildings that contain lead and asbestos. Ms. Grantham-King's sense of partnerships is that every client becomes a partner by providing valuable feedback and resources. Currently the company is exploring ways to be more available to students from HBCUs.

Question and Answer Session

A lively Question and Answer session followed. A few of the questions are reported here.

Question: What types of private industry are there in the weather business?

Dr. Ed Johnson answered this. He differentiated some of markets:

1) The media.
2) Information companies, producing and packaging information for use by the media.
3) Consultants to other industries, for example, the power companies are highly dependent on weather analysis. This last group is the largest. Most businesses can correlate sales against weather and thus predict profits. For instance, bad weather drives down fast food sales but increases pizza sales because pizza is delivered to your door.
4) Forensic meteorology.

Question: How do you respond to critics at federal agencies who say: "Well do these MSIs have the capacity to do what we really need?" With smaller federal funding and fewer alumni/ae at these agencies, how are MSIs realistically able to compete?

Dr. DeLois Cutter: "We just have to come up with innovative ways to create an infrastructure of a partnership to make these kinds of relationships work." Ms. Cathy Fore: "We must create centers of excellence and enterprise regionally, located across the country to share equipment, funding, and expertise. We must also take advantage of what we already have; we should be sharing more information through the Internet."

Question: What different paths can I take with a major in meteorology and an MBA? (Ms. Felicia Evans, Penn State University)

Mr. Lawrence Tynes responded that "The MBA in a meteorology degree is great, but you still want to concentrate also on research and computer sciences, particularly writing peer reviewed articles and learning C++." Mr. Robert Stockman added that the student might consider working for the State Department, consulting on meteorological and economic development in foreign countries.

Question: What creates a successful partnership?

- Be prepared with the right skills.
- Base the partnership on each party's competencies. Don't try to partner with everyone. Find the partnership in which the merger creates a well balanced, diversified, field of knowledge and resource.
- Remember to pay attention to motivation. A partnership works when each party feels it is serving its own self-interest.
- Make a long-term commitment.

- Attend to the needs of the partnership through networking, mentoring, and good communication.

Panel B—Converging Business and Academic Practices

Moderators: Dr. Mildred Ofosu, Delaware State University
Dr. Fred Thurberg, National Marine Fisheries Service, NOAA
Panelists: Dr. Barry Costa-Pierce, Mississippi-Alabama Sea Grant
Mr. Clinton Twilley, Concurrent Technologies Corp.
Mr. Eddie Hanebut, Digital Quest
Mr. George Brooks, University of Arizona
Mr. Gale Burkett, GB-Tech, Inc.
Dr. Kelton Clark, Morgan State University
Dr. Richard Gragg, Florida A&M University

A Primer on Aquaculture

Dr. Fred Thurberg gave a short talk on aquaculture. Aquaculture is the process of raising aquatic organisms for human consumption. NOAA, as a marine agency, is involved in the aquaculture of marine species, as opposed to fresh water species, and works with academia and the business community in a fashion similar to the way the Department of Agriculture works with land-based farmers.

Interest in marine aquaculture has increased recently in NOAA for four reasons:

- An increase in seafood consumption in the U.S.
- An increased awareness of the health value of seafood.
- A decline of wild-caught fisheries from overfishing and habitat degradation, including pollution and coastal development.
- An imbalance of payments as the U.S. imports more aquacultured products from abroad.

This interest in NOAA is not new; the Milford Lab was established in the 1930's to assist the oyster business community. This was an early partnership with the shellfish industry in Long Island Sound and Yale University. So the partnership that we discuss today has been operating at some level for a long time. Similar partnerships on the Gulf Coast and the West Coast with shrimp and salmon also have long histories.

Diversity, NOAA and Aquaculture

What is NOAA doing to actively involve minority communities in the business of aquaculture?:

- **Aquaculture in High Schools**

The Milford Lab has been involved in a partnership with two urban technical high schools in New Haven and Bridgeport, Connecticut; both schools have significant minority enrollment. We have been working with these schools and the shellfish industry in a joint venture to develop cost effective methods of shellfish production. The students obtain hands-on experience in the laboratory, classroom, and in the field, growing and harvesting shellfish. This program has been very successful and many of the students go on to post-graduate studies in the marine field.

- **Urban Aquaculture Initiatives**

There is a growing interest in recycling old industrial buildings, especially old mill and factory buildings abandoned as manufacturing left New England. These buildings provide the large spaces needed for aquaculture tanks and are available at a fraction of the cost of new construction. Many New England colleges and universities are now developing partnerships with fledgling aquaculture ventures in this effort. Sea Grant is also a major player in this area, and the urban setting offers many opportunities for minority participation.

- **NOAA Sea Grant Program**

Sea Grant offers many opportunities that encourage partnerships with government, business and the academic community. Five million dollars in competitive grant money is now available on a recent Sea Grant—administered Request For Proposal (RFP).

- **Native American Involvement**

Many Native American groups have been involved in aquaculture practices for hundreds of years as they have long recognized the wisdom of protecting and nurturing marine food resources. Tribes on Cape Cod and its Islands, on Puget Sound, and recent activity in Connecticut are but a few examples of very active Native American involvement in the business of aquaculture. Dr. Brooks described the role of Native Americans in aquaculture business activities in Arizona.

Mississippi-Alabama Sea Grant Consortium

Dr. Barry Costa-Pierce spoke about the Mississippi-Alabama Sea Grant Consortium. Sea Grant implements national ocean and coastal priorities at the national, state, and local levels. There's a Sea Grant program in every coastal and Great Lakes state in the country, including Puerto Rico and Guam. We use federal monies for sustainable coastal and ocean zone programs for direct public benefit. Sea Grant was modeled on the American dream of Land-Grant. Back in the 1800s, this wonderful system of Land-Grant universities was created to insure that Americans had access to a safe and reasonably costing food supply. Projections are that the U.S. economy will change in the 21st Century to yield as much of a gross economic product from the oceans and the coastal zones as from our inland agriculture areas. The Mississippi-Alabama consortium is a consortium of eight public research universities and laboratories that support education, marine research, and outreach for direct public benefit.

International Partnerships

HBCUs and MSIs can take the lead in forging international partnerships vital to the future of this country. Despite the calls for globalization, the U.S. is pulling back from international partnerships. But international partnerships are the key to development. Africa is particularly critical here. Three universities have already taken steps to focus on aquaculture: Makerere University in Kampala, Uganda, The University of Namibia, and Rhodes University in South Africa. These African universities have targeted marine and freshwater sciences and sustainability as their signature programs. Here is a tremendous opportunity for the Historically Black Colleges and Universities to develop real partnerships. In our hemisphere, the UABC in Encinada is very desirous that America sees beyond its borders and develops new kinds of partnerships for interns, undergraduates and graduate students with the HBCUs.

Tripartite Partnerships

It is quite easy to team an academic institution with a federal agency. However, to get a tripartite relationship among private industry, academia and the government is much more difficult. One of the things we need to look more closely at is requiring that some of our grants have an industry component from the outset.

Management Systems

There is an increasing number of regulations and standards required in business. Even the federal government has begun policing itself to make sure it implements its own environmental standards. The process of incorporating these environmental standards can be daunting. It is important, says Mr. Clinton Twilley, and to do this well, you must have the resources of understanding this business language. Concurrent Technologies Corporation provides the framework for implementing a management system to support quality and reduce environmental impact. Mr. Twilley says the key to designing and implementing a new management system is to keep it simple—always make sure the procedures are necessary, clear, and well communicated. Train for designing a new system by becoming familiar with new technology available. Get help from an outside firm that can see your company more objectively. Identify all the steps that are required in your business and document them. And finally, make sure you have a system for regularly improving and updating your procedures.

MSCI, the Mississippi Space Commerce Initiative

MSCI is a consortium of education, industry, and government agencies banded together for the commercialization of space. One of the things MSCI does is to promote GIS remote sensing technology in the schools, teaching students how to collect data and create maps of their own school neighborhoods. The development of three-dimensional maps, created through satellite information, is an emerging industry with a tremendous potential for growth. These maps can help students make connections between geographical features of their neighborhoods, countries, foreign lands with social customs and economic development.

Using this technology, weather patterns, environmental issues, even insurance assessments can be made. We can track data over the long term. And what is perhaps most exciting is that this technology is easy for students to use. They can quickly participate in the collection of data, and in the process of learning this, students are introduced to many more complex statistical and mathematical procedures. Our most successful programs are long-term, three years in which they analyze data from their own school area.

Synergistic Partnerships

There are opportunities for science, academia, the public sector and the private sector to work together toward common goals. Exercising such opportunities is common in engineering, but uncommon in biological sciences, ecology, and natural resource restoration. However, it can and should happen, says Dr. George Brooks. He gives an example from the situation of the Colorado River, which was designated by the Fish and Wildlife Service (FWS) to be extremely environmentally damaged, so damaged that unless restored, it could threaten future water diversions.

Considering that Los Angeles, San Diego, Las Vegas, Phoenix and Tucson all get significant portions of their water from the Colorado, the potential for a disruption in the water supply was great. An organization called the Lower Colorado Multi-Species Conservation Program or LC-MSCP was created to form an Environmental Impact Statement (EIS) on the plans to restore the river. In the mean time, FWS designated critical habitat on the river for four species of endangered native fish and mandated their restocking to preserve their populations until the river can be restored. In normal times one would go to a federal fish hatchery to produce enough fish to be stocked. These however were/are not normal times. Due to federal cutbacks and numerous other reasons, there are no hatcheries with the ability to "grow out" (grow to a certain size) one of these species, the bonytail chub.

With no federal or state facilities available, the challenge in obtaining enough bonytail for the interim conservation measures had presented scientists with a bit of a dilemma. This situation presented an immediate opportunity for a synergistic partnership. I proposed that a commercial fish farm on the Gila River Indian Community could be the key for producing the needed fish. Growing fish is their job, they do it every day, and they must do it well to stay in business. The response was, at first, less than enthusiastic. There were many concerns, for example, the need for Ph.D. level expertise and the concern that commercial farmers would attempt to breed and artificially modify the fish's genetics. There was also the philosophical problem of someone making money off of an endangered species. All of these problems were easily solved. I would provide the Ph. D. level supervision and the fish would only be grown out on site with no reproduction allowed. All fish stocked would be allowed to grow to size, thus preserving the genetic integrity. The philosophical challenge was addressed by the win-win situation. It would be less costly for the commercial farm to grow the fish, thus saving the government considerable funds. Conversely the commercial fish farm would be producing a product for a guaranteed market for a price far higher than any other product. In addition to a highly endangered fish being recovered, the fish farmers would have an opportunity to work with the federal government establishing the foundations for

future relationships. Further benefits would occur. Since the project was located on an Indian community, it would train minorities in fisheries and provide economic opportunity. It would also produce scholarly papers providing new information to the scientific community. Finally, this concept would bring together formally antagonistic parties into a synergistic working relationship with great future possibilities.

The most crucial lesson learned from this experience was that we need to train our scientists to embrace risk, to think outside of the box, to lead when others stumble.

Florida A&M University

Dr. Richard Gragg spoke about two successful models at FAMU which follow the corporate world. One is the FAMU industry cluster where about 70 corporations support FAMU financially. These corporations provide internships and scholarships for students and research sabbaticals for faculty. The second is a coop program where students intern for a semester. One that I'm particularly involved in is the Comprehensive Everglades Restoration Project. As the director of the Center for Environmental Equity and Justice, we've helped the Army Corps of Engineers in the South Florida Water Management District put together a socioeconomic environmental justice management plan for the Everglades Restoration Project.

In environmental justice we look at the disproportionate impact of environmental pollution and environmental stressors on low income and minority populations. Geographical information systems are a very important tool in understanding what those impacts are and in developing intervention and mitigation solutions. Carbon/nitrogen cycling is a very important long-term research project in which academia and business need to cooperate. Biotemediation is needed to assess and attempt to clean up the pollution without further harming the environment. And all of this work is predicated upon an understanding of environmental ethics. It's important not only for students, but also for business managers, owners, and workers to understand our role, the human role in relationship and responsibility to the environment.

Thus, we must be engaged in a collaborative partnership, diverse in its purpose and direction and attentive to creating sustainable resources for human activities and mitigating human impact on the environment in specific and important habitats. University scientists and engineers need to be more aggressive with regards to technology transfer. Industry, small and large, should acknowledge the diversity of universities – each research site comes with its own culture. FAMU has established an Office of Technology Transfer which provides training on patents and other issues of technology transfer. We have established in the environmental sciences a recognized center for environmental technology transfer. Industry should invest in the HBCUs in the same manner that they invest in majority institutions. They should establish research centers, build research laboratories, support Ph.D. students, establish endowed chairs—we must go beyond internships.

Conflicts of Value

Dr. Kelton Clark briefly discussed the ways in which business and science interact, specifically two cultural values which may lead to conflict in partnering.

- **Disclosure of Information**

One of the first values, in science, is the disclosure of information. Scientists believe we're here to add to the body of knowledge. That is our purpose. Once we unlock a mystery, we must disclose it to the rest of the world. The prestige and careers of scientists are based on the quantity and quality of information they have supplied. We have formalized the disclosure procedure through scientific journals, seminars, and meetings. In contrast, the business community has many reasons for limiting disclosure. The disclosure of such information as marketing strategies, product formulas, or source code can be devastating to a company's welfare. The knowledge a scientist discloses may be detrimental to business and that often causes conflicts between science and business.

- **Objectivity**

Another important value within science is objectivity. In academics, we see ourselves as the ones who are doing pure science. We can be purely objective because all we are interested in is the question. There's a sense, a perception from some scientists, that as we move away from this ivory tower, you move away from objectivity. When you go into policy or management, you have other pressures on you—political and social pressures. These other pressures may influence your objectivity. It is the backdrop of this hierarchy that scientists interact with business.

This is not to say that there's no way that these two institutions can work together. There are many models where they do. A very strong model, where ecological sciences and business work together, is aquaculture. Here both parties have similar interests in knowledge. For example, a biologist may want to know what physiological factors influence growth in fish; a fish farmer wants to know how to grow fish faster. There is no problem with disclosure; the fish grow faster and everybody's happy. In ecological and environmental sciences, there are also industries that are created by scientific disclosures. We have many people in mitigation, brownfield cleanups, and so forth that exist because some scientist made a disclosure and that knowledge created the need fulfilled by industry.

For our discussion here, perhaps the most crucial thing about academic and business partnerships is money. Science, in the African-American community, has been limited most often to medicine. When a child says, "I like to look at bugs," no one says, "Oh great, you can be an entomologist, an environmentalist, a biologist." They say instead, "Oh, you'll be a great doctor." Part of that is because the community doesn't see the economic incentives in being any other kind of biologist. It's important that all the opportunities in the biological sciences are made clear. Cooperation and partnerships between scientific and business entities can help this. With these partnerships, we can say to the community, "So, your child doesn't want to be a doctor? Well, let us show you that they can still make money in the ecological fields."

PUBLIC SECTOR

Panel A—Increasing Access to Public Resources

Moderators: Mr. Benjamin Watkins, NESDIS, NOAA
Ms. Rita Presley, Jackson State University

Panelists: Dr Jewell Prendeville, National Science Foundation
Dr. Robert Menzer, National Center for Environmental Research
Ms. Jan Kucklick, OAR, NOAA
Ms. Jacqueline Rousseau, USEC, NOAA
Mr. James Harrington, NASA
Mr. Anthony Overton, University of Maryland Eastern Shore
Dr. Teferi Tsegaye, Alabama A&M University
Ms. Julie Marcy, U.S. Army Corps of Engineers

Opening

In his opening remarks, Mr. Benjamin Watkins indicated that the public sector plays a major role in the atmospheric and ocean sciences, utilizing public resources to engage and build capacity. In this session, the diverse group of speakers would look at solutions that use the public sectors' resources in addressing issues of capacity building at minority institutions. All interested institutions that offer opportunities to grow in the diverse community, particularly the under-served communities, must be engaged and relationships between the public sector and the academic community should be encouraged.

Ms. Rita Presley welcomed attendees and introduced panelists.

U.S. Army Corps of Engineers

Ms. Julie Marcy, the strategic planning manager of the Vicksburg District, U.S. Army Corps of Engineers in Vicksburg, Mississippi indicated that the District encompasses portions of Arkansas, Mississippi and Louisiana, and covers approximately 65,000 sq. miles. There are also contracting offices in New Hampshire, Illinois, and Alexandria, Virginia. The mission is to provide quality engineering and other professional services in an economically and environmentally sustainable manner. The wide range of key products and services includes traditional flood damage reduction efforts where dams and other control facilities are built. Services also include environmental stewardship of 500,000 acres and the issuance of regulatory permits under the Clean Water Act, and Rivers and Harbors Act. Also provided is hydropower, water supply, and emergency response. Work is performed for the Army, Air Force, as well as local state, and federal agencies. Although the national goal of the Corps is setting aside about 5% of contracting efforts for minority institutions, the Vicksburg District tries to do 10%. The District has existing partnerships with Alcorn State University, Southern University, and Jackson State University and looks forward to working with more minority-serving institutions.

Alabama A&M University

Dr. Tsegaye-from Alabama A&M University discussed the University's mission to expand research and development and the primary science objectives for years 2000-2005.

NOAA's Coastal Services Center

Ms. Jan Kucklick works at NOAA's Coastal Services Center. Work is being conducted with state coastal resource managers to link people, information, and technology. Under the mission to make information accessible to people, the focus is on four theme areas—hazards, habitat, smart coastal growth, and national spatial data infrastructure. The Coastal Management Fellowship Program is in its sixth year. This program places post-graduate students to work for two years with state coastal zone management programs. The fellows are paid a stipend and per diem. It's a multi-step process where states compete to host the fellows and interested applicants compete to be placed as fellows. Local Sea Grant directors interview interested candidates and then submit two names for consideration. A national review panel then selects finalists from the Sea Grant nominations. After a week-long interview process, fellows are selected from the finalist pool. This program is a great opportunity for students to get experience on the state and local level.

The organization is in the process of trying to form a new program targeted to minority schools, but this is on hold pending funding. However, NOAA has several other programs including the Nancy Foster Scholarship Program and the Knauss Fellowship Program. Information on these fellowships and a number of other ones can be found on the web at http://www.csc.noaa.gov/cms/fellows/opportunities.html.

Cooperative Research Unit Program

Mr. Anthony Overton from the University of Maryland discussed the Cooperative Research Unit Program. The program is located in 37 states throughout the U.S. and was developed to provide a link between federal, state, and local governments to personnel at the university level through cooperative programs. Each unit represents a formal partnership with the U.S. Geological Survey (USGS). These units usually consist of a Wildlife and Fisheries Division. A host university generally provides space for unit personnel who teach classes at the university and serve as academic advisors for graduate students. Much of the funding is through federal and state agencies. Funding allows graduate students to interact with federal and state agencies. The unit program has been prospering and increasing the number of minorities involved in Wildlife and Fisheries—particularly, the units at the University of Maryland Eastern Shore, Grambling State University, and the University of Arkansas-Pine Bluff.

NASA Programs

Mr. James L. Harrington, Jr, Manager of the NASA–MU-SPIN (Minority University–SPace Interdisciplinary Network) Program indicated that NASA conducts relevant scientific investigations via its Earth Science Enterprise (ESE) which provides annual NASA Research

Announcements (NRA) for research and education in all the ocean/marine, environmental, and atmospheric (OME&A) fields for which academic institutions can apply.

The NASA Office of Equal Opportunities Programs of NASA Headquarters is the home of the Minority University Research and Education Division (MURED). This division's activities are targeted explicitly at HBCUs and MSIs. Additionally, each NASA Field Center hosts a MURED program office and support activities. The MURED program solicits opportunities for NASA research and education on an annual basis. The MURED Office entertains unsolicited opportunities when funding is available. The NASA Field Center MURED programs manage and support NASA research and education opportunities that are of particular interest to the activities conducted at the Field Centers on a solicited and unsolicited bases.

The MU-SPIN program funds, in collaboration with the City University of New York, a Metropolitan Weather Network (METNET) that spans from New York/New Jersey to Maine. This weather network has been supported by the Weather Service field office in New York as well as the Weather Service Office in Silver Spring, Maryland. The network consists of weather stations installed at predominantly minority attended K-12 institutions throughout the metropolitan area and Maine. The stations and the station data are calibrated and certified by the Weather Service personnel. The weather network provides a foundation for minority K-12 students to learn about weather and climate trends and the integrity of the data provides valuable information for university meteorologists and climatologists to study phenomena such as urban heat island and lake effect storms.

MU-SPIN has been very pleased with its collaborations with NOAA and the Weather Service in particular. The Weather Service participation brings a level of competency in the network that is required by everyone from the universities to the Mayor's office.

The Program is funded via a collaboration of MURED, ESE and the NASA Office of Space Science. The funding is very stable as long as the program continues to produce strong relationships between the funding sources and HBCUs and MSIs. The Agency's funding is allocated via the national discretionary budget for Science and Technology.

All of the NASA Enterprises depend heavily on the NASA world wide web sites and, to some extent, the Commerce Business Daily. World wide web sites are dedicated to the communication of the mission and goals of the enterprises, as well as announcements for opportunities (AO) and NRAs.

New programs include increased focus on developing partnerships through direct relationship building with mission managers and university researchers and students for teaming on future missions. The requests for proposals are developed in collaboration with ESE at NASA/HQ in partnership with the mission managers at the NASA Centers.

EPA Grants And Fellowships Programs

Dr. Robert E. Menzer, Senior Science Advisor, National Center for Environmental Research (NCER), explained that the U.S. Environmental Protection Agency (EPA) writes regulations that protect the environment. It is a research and educational organization composed of three parts: the Program Offices, i.e., Office of Water, Office of Air and Radiation, Office of Solid Waste and Emergency Response which are responsible for the translation of Federal legislation into environmental regulations and guidelines; the Regional Offices, which enforce regulations and provide service and assistance to local and state governments in environmental protection; and the Office of Research and Development (ORD), which provides the research support for the Program Offices and Regions to carry out their activities. NCER is ORD's extramural research arm. It supports research through its grants and fellowships programs. There are three fellowship programs with some fellowships specifically for minorities. Its grants and fellowships programs are known as the Science to Achieve Results (STAR) Program. Continuing areas of emphasis include ecological risk assessment, human health risk assessment, particulate matter, drinking water, endocrine disruptors, global change, children's health, pollution prevention, and socio-economic.

NCER supports a number of educational activities including both undergraduate and graduate fellowships, post-doctoral fellowships, and internships.

Graduate Fellowships are offered for study in accredited U.S. colleges and universities and provide a stipend for the student, tuition payment to the institution, and a research and expense allowance. There is a special set-aside program for fellowships that are tenable only at HBCUs, Hispanic-serving institutions, and Native American Tribal colleges. All of these graduate fellowships are highly competitive.

Undergraduate fellowships are available to students who plan to study at minority institutions, including HBCUs, Hispanic-serving institutions, and Tribal colleges. These support the last two years of undergraduate study and offer an internship at an EPA laboratory during the summer between the two years.

NCER is particularly committed to making the results of the research it sponsors available to the public. It provides the abstracts of all research grants it supports, annual and final reports of grants, and research summaries on special topics which are prepared from time to time. It also sponsors conferences and workshops on specific topics, including periodic progress reviews of the specific grant programs it sponsors. All of this information is posted on its web site and is fully searchable by keywords.

The NCER web site address is http://www.epa.gov/ncerqa. Register your e-mail address with the server to receive communications.

New NSF Program in Geosciences

Dr. Jewell Prendeville of the National Science Foundation is Staff Associate for Diversity and Education, directly under the Assistant Director for Geosciences. The program funds outreach and education programs. There are three program components—Opportunities for Enhancing Diversity in the Geosciences NSF 01-36, Geoscience Education NSF 01-42, Digital Library for Earth System Education (DLESE).

www.Geo.nsf.gov/Geo/diversity.org is the website where information can be found. This is the first year for the Diversity Program. There is about $3 million in funding to be funded under the OEDG Program Solicitation. Awards will be made for up to three years—$400K. The NSF has a lot of other programs it funds that may be viewed on the NSF web site at www.nsf.gov.

NOAA's Educational Partnership Program with Minority-Serving Institutions

Ms. Jacqueline Rousseau gave a presentation on NOAA's new Educational Partnership Program with Minority-Serving Institutions. The agency has been developing this program for the past three years and received $15 million in funding in FY 2001. The program has two principal objectives —to provide funding to increase the number of under-represented students who pursue and graduate in NOAA-related sciences, and to increase research collaboration between NOAA and the minority-serving institution community.

The National Oceanic and Atmospheric Administration (NOAA) has been collaborating with Minority Serving Institutions (MSIs) for the past twenty-five years. The agency has ongoing programs with schools such as Florida A&M University, Jackson State University, Hampton University, and the University of Puerto Rico. This new initiative, however, provides a consolidated partnership program with minority academic institutions to increase the number of individuals trained in the core programmatic areas of atmospheric, environmental and oceanic sciences.

Since approximately 40% of minorities receive their undergraduate degrees at MSIs, the agency has focused its FY 2001 initiative on working with the MSI community to build the capacity and increase graduate granting programs in atmospheric, earth and oceanic sciences and remote sensing at their institutions.

The NOAA Minority-Serving Institutions Initiative consists of four new programmatic components.

- Establish Cooperative Science Centers that will concentrate on Atmospheric Environmental and Ocean sciences and Remote Sensing.
- Develop an Environmental Entrepreneurship Program
- Establish an Undergraduate Scholarship Program to support the training of students attending MSIs and trained in NOAA-related sciences.
- Establish an NOAA Graduate Sciences Program.

The intent of the initiative is to support the development of quality education necessary to serve the interests of NOAA, and the nation at large, using natural and established linkages between MSIs and Federal government institutions, in conjunction with other research institutions and the facilities of NOAA. It will also provide opportunities and available programs for students and individuals in related professions to pursue research and educational programs in atmospheric, environmental, and oceanic sciences, principally among MSIs.

All four programmatic components have been initiated in FY01. The following provides the status of each sub-program.

Undergraduate Scholarship Program: Eight MSI .students are currently participating in this ten-week paid internship program initiated in May 2001. Funds will also be provided during the academic year and for ten weeks next summer for students who maintain an acceptable GPA and continue academic training in a NOAA-related field. ($221,000)

Graduate Science Program: Six MSI students will receive financial assistance for graduate level training in a NOAA mission related occupation beginning in September 2001. Five students completed their training under the program last year and have been placed in permanent positions at NOAA. ($525,000)

Environmental Entrepreneurship Program: Twelve grants will be awarded to MSIs in support of program development and environmental restoration activities in NOAA-related areas during September 2001. ($3.3 million)

Cooperative Science Centers: NOAA will announce the results of the competitive process to designate MSIs as Cooperative Science Centers in atmosphere, ocean and environmental sciences and remote sensing in August 2001. ($10 million)

For further information on this program, please contact: Scott Carter, NOAA Office of Legislative Affairs at (202) 482-5426.

Panel B–Sustaining Linkages for Social and Economic Development

Moderators: Dr. Arthur Allen
Dr. William Parker, National Weather Service, NOAA

Panelists: Dr. Ken Davidson, NESDIS, NOAA
Ms. Michelle McCoy, EASC, NOAA
Dr. Barbara Ousby, Mississippi Development Authority
Dr. Mack Felton, Dillard University
Dr. Darryl Keith, EPA
Mr. Donald Wernly, NWS

National Climatic Data Center

Dr. Ken Davidson, the Deputy Director of the National Climatic Data Center in Asheville, North Carolina, gave an overview of the Center. NCDC's mission is to acquire, ingest and provide access to all of the globe's climatological data. NCDC's data archives, which are required by law, hold over a petabyte. To get a sense of the work NCDC does, one routine project NCDC did for FEMA was to plot all the hurricane tracks that we had any record of, where they made landfall, what the damages were, and what kind of damage. NCDC also develops the climatologies for the country. These are passed on to the state climatologists in every state in the country.

The Office of Acquisition Management

OAM's mission is to provide an acquisition environment that promotes the achievement of program missions while protecting the public interest. Ms. Michelle McCoy is a small business specialist at The Office of Acquisition Management. She argues that in 2001, MSIs need to think like small businesses, to actively market themselves to potential partners. She offered the following list of questions:

- What services or products do you have to offer to the government?
- Do your products or services fill a need that the government has?
- Who or what is your competition?
- What is your advantage over other HBCUs and MSIs?
- Can you create a demand for what's going on in your environment?
- Who are your potential customers?

She also offered the following tips for MSIs and small businesses interested in marketing themselves:

- Network
- Contact the National Contract Management Association which provides free training
- Create a distinctive name/name brand
- Be competitive in pricing
- Form partnerships
- Follow through on contracts
- Offer excellent service
- Practice diversity marketing
- Provide quality goods
- Be innovative, competitive, and resourceful
- Use the resources of the SBIR and OSBDU (Office of Small and Disadvantage Business Utilization)

Ms. McCoy actively encouraged MSIs and small businesses to partner for contracts. In the past two years, her office awarded over $600 thousand to universities for contracts and purchase orders. She gave some examples of recent contracts: scientific diving and archeological services, ship time on the research vessel Cape Fear for the 2001 monitor expedition, acid rain study, analysis on

stable isotopes and salmon scales, and more. Many of these are advertised in the Commerce Business Daily. She urged MSIs not to overlook these resources and to check out the NOAA web site for more opportunities.

Mississippi Development Authority

Dr. Barbara Ousby talked about the vital role this state agency plays working with Institutions of Higher Learning in Mississippi: "We provide paid as well as unpaid internships with the universities, and we provide grants for energy-related research. One particular project I can highlight is with Jackson State University collaborating with the Department of Environmental Quality (DEQ). We provided funding for internships at DEQ for the oil and gas database. This database is vital to Mississippi because our state is number 12 in the nation for oil production as well as 16th in the nation for gas production, for economic development and for energy conservation." The Department of Environmental Quality was awarded a grant to pay students in the Computer Science Department at Jackson State University and Hinds Community College to participate in data collection, computing data, and inputting data in a specific model/format. We have unpaid internships with the Public Policy Program at Jackson State University where the students are assigned to MDA-Energy Division to perform tasks that are outlined in the agreement between the entities. Alcorn State University (ASU) is involved in several research projects funded by MDA. ASU is developing a Small Farm Database and conducting resource assessments specifically on Mississippi in GIS format. ASU has also received funding for the Center for Energy Resource Development (CERD) which will be housed on-site at the university. CERD has four major components: Comprehensive Energy Strategy, Utilizing the Fuel Cell, Development of Sustainable Technology and Power Quality and Reliability. Mississippi State University received funding to perform all pre- and post-analysis on water treatment and how energy efficient this innovative technology is that is housed a major swine facility in Mississippi. These are all examples of how the Mississippi Development Authority plays a role in Sustaining Linkages for Social and Economic Development."

Reflections on HBCUs

Dr. Mack Felton reflected on his long tenure with HBCUs. The following are ways he feels HBCUs can better improve the sustainability of social and economic development.

- Promote and offer adult education
- develop and improve programs in fisheries, environmental sciences and atmospheric sciences to compete with majority institutions
- Actively promote HBCUs' capabilities
- Cultivate industry – take an active approach to business partnerships
- Become centers of new research and new cultural activities to draw in the community
- Support partnerships that have good environmental practices

Environmental Protection Agency (EPA)

Dr. Darryl Keith, an oceanographer with the EPA, said the EPA depends upon contract work and outside research and actively seeks to develop cooperative relationships with universities to address problems of mutual interest. For instance, in the EPA National Center for Environmental Assessment (NCEA), they have a component where they do NSF style proposals and there's a competition for a pot of money as long as that research is related to an EPA problem. This allows the EPA to expand its range of activities by having basic research done that it's not able to do.

The EPA has made a vital change in its relationship with outside contractors and communities. Formerly, the EPA would come into your area, state what the problem was, and throw money at you to get it solved. "Now, the agency has developed cooperative relationships with local communities whereby we come in and we speak with local folks. We speak with the businesses. We speak with the academic side and we try to come up with what is the community perception of the environmental problem. And once we have identified the problem or problems, then we come up with agreed strategies to solve the problems."

This cooperative approach has also improved relationships with the HBCUs and MSIs. The EPA offers internships and research opportunities, and it has a summer hire program. The EPA signed a Memorandum of Understanding with NAFEO to set up a faculty exchange program where faculty at MSIs can come to EPA laboratories to work as colleagues or to conduct research at EPA institutions. And then there have been EPA initiatives, like Dr. Felton had mentioned, where EPA contributes along with other federal agencies to form alliances with HBCUs.

One of the questions posed at this Conference is "What characteristics must an institution possess to be competitive for funding?" The bottom line is you have to prove you can do the work that's being proposed. How can you prove that you can do the work? For data analyses, one sure indicator was if the laboratory at your institution participated in a round robin exercise with other laboratories and you met the quality control criteria that the agency standard has established.

National Weather Service: Communicating Uncertainty

Mr. Donald Wernly started his talk by showing a chart that listed the U.S. as the most hazard prone nation on the globe, except for China. He gave some examples of this. By 2010, the hurricane prone county populations will double to 75 million—that's just the counties along the immediate coasts, along the Atlantic and Gulf. This amounts to around $7 trillion of insured property value—and potential loss. What NOAA and NWS do are basically two things: One, the prediction of extreme events moves people out of harm's way. Two, the data collected enable people to keep themselves from harm's way. NWS is successful at these two things, but what we don't do well is to communicate what we know to the decision-makers. Forecasts have error. What NWS needs to do is to quantify the uncertainty in a forecast.

Let's give an example. How long does it take to evacuate New Orleans for a category 5 hurricane? Seventy-two hours. How far in advance do we issue a hurricane warning? Twenty-four hours. There's a problem with that gap. We need to figure out a way to gauge and communicate the

range of possibilities. The same thing is needed in the Advanced Hydrologic Prediction Service. We need ways to help city managers do their jobs. So there are many opportunities in this new area of assessing and communicating uncertainty.

STUDENT

Panel A—Creating Paths to Success in Marine and Atmospheric Sciences

Moderators: Mr. Jose Garcia, National Weather Service, NOAA
Dr. Dionne Hoskins, Savannah State University
Panelists: Dr. Michael Fogarty, National Marine Fisheries Service, NOAA
Mr. Ricardo Lopez, California State University, LA
Dr. Pace Wilbur, National Ocean Service, NOAA
Ms. Andrea Sealy, Pennsylvania State University
Dr. Randal Mandock, Clark-Atlanta University
Mr. M. Brandon Jones, university of Delaware

Every panelist addressed the same list of questions relating to student success. Dr. Michael Fogarty remarked that this session was the "heart and soul" of the Conference as the students were the people who would eventually carry on the social and scientific work already begun.

Pivotal Transition Points in Careers

Dr. Fogarty saw two pivotal transition points. First is the recognition that the career one envisions is not the career one will have – in other words, translating dreams to reality. In his case, he had envisioned his career to be like Jacques Cousteau, and although it has not been that, it has been deeply interesting. The second is the move from supervised research to independent, autonomous research, which requires one to carefully choose the questions to investigate.

Mr. Ricardo Lopez saw his greatest challenge as the transition after graduation to non-student life. Since life as a student is so structured, there was a sense of losing a safety net.

Ms. Andrea Sealy recognized that the transition points are not simply academic, but are cultural as well. She came from Barbados to attend school in the U.S., first at Jackson State University and then at Pennsylvania State University. Each time she had to adjust to a new culture, first from the Caribbean to North America, then from a HBCU, where the racial demographics were the same as Barbados, to a majority institution.

The Necessary Attributes and Skills for Success

Panelists mentioned several of the same qualities. Two of the most frequently mentioned were discipline and perseverance. The sciences require self-motivation, the ability to set one's own goals, and the dedication to pursue a constant path despite puzzling and unexpected research

outcomes. Everyone emphasized having strong analytical skills, including mathematical and statistical training, and good written and oral communication abilities.

Active patience is the term Mr. Ricardo Lopez uses to describe being patient with one's self, particularly during times of transition. Active patience means being patient but proactive, acknowledging that from difficult times comes personal growth. Another vital skill is always approaching one's work with a sense of professionalism.

Dr. Wilbur encouraged everyone to "think outside of the box," He advocated becoming a solid team player, one who enjoys solving problems with others. And he placed emphasis on learning about and from the community, particularly in coastal management and environmental sciences.

Ms. Andrea Sealy listed five vital requirements for success: (1) practicing time management, (2) having a strong mentor, (3) getting early experience with research, (4) developing strong computer programming and modeling skills, and (5) learning to be flexible in one's approach.

Dr. Mandock, in addition to seconding the skills Ms. Sealy listed, added two others: Clear thinking and having a solid ethical framework. Both of these allows one to recognize opportunities and pitfalls along the way.

Assessing Progress

There are obvious benchmarks in the sciences: success in publication, obtaining grants, and peer recognition, including having the support of colleagues. But less obvious assessments are critical as well, particularly having open dialogue with colleagues and mentors. Critical feedback, comments, and compliments guide one's process as a student and human being.

Opportunities for Training

There are a number of training opportunities for students. Panelists mentioned student internships and summer employment in government and private industry laboratories. Student assistantships for both teaching and research will provide training for those going into academia. Make sure to take advantage of professional organizations, particularly those geared towards supporting under-represented groups.

Emerging Issues

- The potential effects of global climate change on marine production properties of ocean ecosystems.
- The ecosystem effects of fishing.
- GIS (Geographic Information System) Technology

Panel B—Becoming a Professional in Marine and Atmospheric Sciences

Moderators: Dr. Brian Bingham, Western Washington University
Mr. Alonzo Hamilton, National Marine Fisheries Service–NOAA

Panelists: Ms. Pamela Lestenkoff, University of Alaska
Ms. Noelani Puniwai, Washington State University
Ms. Shawn Arellano, Woods Hole Oceanographic Institution
Mr. Ashton Robinson-Cook, Jackson State University
Ms. Wanda Jones, University of Florida, Gainesville
Mr. Anthony Overton, University of Maryland Eastern Shore
Ms. Essie Coleman-Duffie, National Marine Fisheries Service–NOAA
Mr. Lawrence C. Tynes, Sr.

Paths to Careers

The panelists entered the marine and atmospheric sciences through many different routes. Mr. Ashton Robinson-Cook told of a childhood experience with a tornado, Ms. Noelani Puniwai has had a life long fascination with the ocean, and Ms. Shawn Arellano was wondering what career route to take, when a professor suggested the marine sciences. In every case, self-motivation, support from a wide variety of people, a love of learning, and access to strong mentoring programs helped these panelists become professionals.

Opportunities for Students

Ms. Essie Coleman-Duffie compiled the following suggestions for students on their path to becoming professionals.

1. Student Appointments and Employment Programs
   - Student Temporary Employment Program (STEP)
     This program provides paid, flexibly scheduled, work experience not directly related to the student's field of study and career goals.
   - Student Career Employment Program (SCEP) (formerly the COOP Program)
     This program offers valuable work experience directly related to students' field of study and career goals. Students work flexible schedules, but must have a written agreement signed by the institution and Agency Supervisor. Pay is based on education and work experience and is available at all levels of schooling including graduate school. Students may be converted non-competitively to a career conditional or career appointment upon completion of their degree within 120 days. This has been one of the most successful programs that NMFS has used, especially as it relates to bringing new scientists on board.

2. Grant & Internship Opportunities
   There are a number of opportunities available within NOAA. The best sources for finding information are checking the website: www.noaa.gov and contacting one of the NOAA Administration Support Centers: www.rdc.noaa.gov/~hrmo/hr.contacts.htm. Some of the

internship opportunities available can provide valuable work experience in the marine and environmental sciences for this agency are the following:

- Nancy Foster Scholarship Fund, www.noaa.gov
- American Indian Science & Engineering Society (AISES), www.aises.org
- Student Conservation Association (SCA), www.sca-inc.org/vol/programs.htm
- Hispanic Association of Colleges & Universities (HACU), www.hacu.net
- Minority Access, Inc, www.minorityaccess.org
- Oak Ridge Associated Universities (ORAU), www.orau.gov/orise.htm
- NOAA Faculty & Student Intern Research Program, www.rdc.noaa.gov/civilr/studprog.htm
- Research Experience for Undergraduates (REU), www.nsf.gov/home/crssprgm/reu/reulist.htm

3. Professional Societies

It is essential to establish linkages with professional societies in this profession. They provide valuable resources and most have scholarships, internships, contacts. The good news is that student memberships are less expensive than regular memberships, so it is feasible to join more than one. A few of the organizations that may be of interest:

- American Fisheries Society (AFS)
- American Society of Limnology & Oceanography (ASLO)
- Gulf Estuarine Research Society (GERS)
- Minorities in Natural Resources Committee (MINRC)
- American Institute of Fishery Research Biologist (AIFRB)
- Ecological Society of America (ESA)
- Minority Professionals in Marine Science (MPIMS)
- American Meteorological Society (AMS)

4. Mentors

Good mentor relationships are critical. Everyone starting out in a career needs a good support system, including a good professional student /mentor relationship. Select a mentor who can provide the following:

- Intellectual support – to guide your professional research
- Professional support – to guide your publications
- Emotional support – to guide you during the difficult times

Related Careers

Wanda Jones reminded the audience that a love for the sciences can translate into many different career paths. Environmental and scientific journalism is crucial to communicate what scientists do to the larger public. Environmental law is another emerging career, particularly in the coastal areas. Other careers include the study of natural history, diplomatic work to form social policy regarding the environment, computer programming for scientific modeling needs, even environmental police work.

Preparing to be Competitive

Panelists emphasized the importance of dedication to the work, of choosing a field that they felt passionate about. Ms. Jones spoke about waking up very early in the morning to study dolphins, despite the fact that she was not a morning person. Mr. Robinson-Cook spoke of needing to take the initiative in achieving goals, even if this feels frightening at first. Ms. Puniwai spoke of the difficulty for many minorities of balancing the needs of the community with personal needs. She reminded the audience that many minorities attend school to fulfill the needs of the community—to be a doctor, to be a teacher—and that it is difficult to see career paths outside of these communal goals.

Communicating the Opportunities

There was a long and rich question and answer period. But one speaker noticed a troubling pattern about the questions, saying, "There are obviously lots of opportunities in NOAA, but from the questions we're getting from the audience, it seems very few students know about these opportunities. How can we communicate them more effectively?" The following were suggestions for NOAA:

- Become a part of the local educational structure
- Publicize the partnerships that exist
- Simplify the structure of NOAA's public relations
- Clarify the structure of NOAA's Line Offices to the public
- Use the Internet to email job listings and opportunities to HBCUs and MSIs
- Ask students who have participated to actively speak about their experiences
- Review for effectiveness and clarity the information that is sent out
- Link NOAA's websites to more popular web areas