UVI's Center for Marine and Environmental Studies: The Path Forward

A report prepared for the:

Virgin Islands Experimental Program to Stimulate Competitive Research (VI-EPSCoR)

at the

University of the Virgin Islands (UVI)

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EXECUTIVE SUMMARY

The Center for Marine and Environmental Studies (CMES) was established as a unit of the Research and Public Service (RPS) component of the University of the Virgin Islands (UVI) in 1999. In recent years, CMES has seen significant expansion assisted by financial resources provided by the Virgin Islands Experimental Program to Stimulate Competitive Research (VI- EPSCoR), a National Science Foundation grant program.

CMES has grown from one to three research faculty members, technical staff has more than doubled, administrative staff has been hired, a graduate program has been developed, adjunct faculty have been appointed, and the facilities have been markedly upgraded at both the MacLean Marine Science Center (MMSC) and Virgin Islands Environmental Resource Station. VI-EPSCoR funding is currently available for five new faculty positions (joint appointments with Division of Science and Mathematics; DSM), four technical personnel, two laboratory spaces outside MMSC, and additional improvements in the MMSC facility. The current VI-EPSCoR research thrust, based in CMES, is Integrated Caribbean Coastal Ecosystems (ICCE). A number of publications, successful grant proposals, and in 2009 the first Master's degrees have resulted from this enhancement in research capacity consistent with the overall goals of VI-EPSCoR to enhance research competitiveness.

As a result of VI-EPSCOR, CMES is now in a position to serve as a model within UVI with respect to integrating research, teaching and public service, and also to providing relevant research and internship opportunities to students. To help CMES achieve its vision of becoming a center of excellence, NSF funded VI-EPSCoR to engage an independent external expert panel to advise CMES upon:

1. Managing growth with respect to management, staffing, and infrastructure requirements;
2. Integrating research, teaching, and outreach;
3. Stimulating territorially relevant research in the natural sciences; and,
4. Enhancing collaborations both within the territory and within the Caribbean.

The panel members made three site visits to the Virgin Islands to gather relevant information. They interviewed CMES personnel, other UVI faculty and staff, as well as UVI higher administration; they met with some other potentiel CMES stakeholders, e.g., territorial and federal government employees, and representatives of non-governmental organizations. They toured field and campus facilities on St. Thomas, St. John and St. Croix. The panel members also reviewed a number of documents supplied by the university.

This document constitutes the panel's final report; it is organized into a "SCOR" format (Strengths, Challenges, Opportunities and Recommendations). In brief, it provides the basis for CMES to craft and implement its strategic plan. It identifies those issues that must be addressed to realize CMES' stated vision, and to capitalize upon present strengths and opportunities.

Strengths: CMES already possesses many strengths. First and foremost are quality personnel, but also location, programs, collaborations, facilities and logistical support.

CMES and DSM administrators, faculty and staff are highly motivated and academically well-qualified with considerable relevant practical experience. UVI senior administrators are starting to develop and implement policies to enable faculty to contribute to all aspects of CMES: teaching, research, and outreach. CMES has a joint graduate degree (Master of Marine and Environmental Science; MMES) with DSM, and a DSM offering (B.S. in Marine Biology) is largely based in the CMES' MacLean Marine Science Center. This pool of students represents a tremendous asset. Many of the CMES and DSM faculty members are actively collaborating with government scientists and other academic institutions. UVI recently has signed several memoranda of understanding with oceangraphic institutions, other academic institutions, and government research consortia to facilitate research and other educational collaborations.

Recently updated field facilities (MMSC and VIERS) of CMES offer good logistical support for field work. In close proximity to these facilities are good examples of coral reefs, sea-grass beds and mangrove forests, and there is ready access to oceanic depths a short boat ride away. These habitats occur in a continuum from relatively pristine to heavily impacted conditions making feasible comparative ecological studies. The islands are also located in a tectonically dynamic area, and in an oceanographic setting on the cusp between the Greater and Lesser Antilles that provide opportunities for addressing globally significant environmental issues.

Challenges: The University of the Virgin Islands has come a long way since its establishment as the College of the Virgin Islands in 1962. Progress has been remarkable in many areas, particularly in the institution's ability to enhance its delivery of quality academic programs. Naturally, many challenges and obstacles remain. That said, virtually all of the challenges identified are shared broadly in the academic world.

One of the greatest challenges is the rapid pace of change at UVI**.** Universities, and particularly the faculty and staff within them, are typically slow to recognize the need for, and accept, change. While UVI does appear to have a highly successful and well-regarded Biology Program, science teaching faculty numbers are limited, and in many cases laboratory facilities for teaching and research need improvement. In general, physical sciences need greater support within the University and need to be augmented, and more science majors need to be recruited into some of these majors. Undergraduate research in marine and environmental sciences needs a greater emphasis in CMES, as does interaction between MMES graduate students and the undergraduates.

Greater clarity is needed not only about CMES' internal organization and responsibility, but also about its evolving relationship with respect to the overall university, most immediately with DSM. Although the joint appointment option is now available, thorny issues concerning implemention (evaluation and appointment processes, proposal review, indirect cost recovery, resource allocation, etc.) have yet to be explicitly addressed. Moreover, UVI has no research center and institute policy to govern the formation, maintenance and dissolution (if necessary) of entities like CMES much less determine their degree of "excellence."

Opportunities: A plethora of present and likely future opportunities for CMES derive from its geographic context, its institutional context, the directions and priorities within the marine and atmospheric scientific community, federal agency funding mandates and priorities and the inherent importance of the coastal ecosystem to the territorial economy.

CMES has yet to take full advantage of the human dimensions and science/policy linkages offered by other units in UVI (e.g., Eastern Caribbean Center, Cooperative Extension Service, Divisions of Humanities and Social Science, Business, Education), and other local territorial expertise. These kinds of collaborations between natural and social scientists, research and educational endeavors, are essential to best serve the territory.

CMES' advantageous proximity to a range of coral reef ecosystems (from deep to shallow) with a range of conditions (from pristine to markedly disturbed), as well as its geologic and oceanographic setting, creates research opportunities particularly because of UVI's location in a U.S. territory, and the parochial inclinations of federal agencies like NOAA, USGS, US F&W, NPS, USGS, USDA and the EPA.

There is a growing international emphasis upon climate change science, hurricane research and integrated oceanographic observing systems. The CMES focus within VI-EPSCoR is in this context remarkably timely in light of the directions and priorities of the federal funding agencies. Finally, the critical importance of the sustainable health of its coastal marine environment to the VI economy, as well as the mandated mission that UVI address issues relevant to the territory, constitutes an enormous opportunity for CMES given its fundamental research emphasis and expertise.

Recommendations: The focus of the Recommendations is on feasible actions relevant to achieving the overall vision of CMES to become an internationally recognized regional center of excellence. Recommendations are divided by time of implementation. Immediate ones require attention over the coming year, and are the only ones listed below. Near-term (2 to 5 years) and long-term (beyond 5 up to 10 years) recommendations are found in the body of the report, and are equally important to the long-term success and sustainability of CMES but either cannot be (or do not have to be) immediately addressed.

CMES Specific

1. Offer joint appointments to all DSM teaching faculty who wish to do ICCE related research, and all CMES research faculty who engage in teaching.

2. Develop a Strategic Plan as soon as possible. This plan should include both personnel and space needs for CMES.

3. Clarify the organizational structure and reporting responsibilities within CMES with respect to services and facilities; afford CMES a regular opportunity to provide comments upon and evaluate the services provided to it by other units.

4. Appoint a CMES Associate/Deputy Director who has full authority in the Director's absence to focus on routine administrative matters in order to free the Director to focus on overall leadership of the program.

5. Develop and implement a space utilization policy and determine priority for office space in MMSC based on the extent to which the office-holder's activities are advancing the CMES mission.

6. Designate an individual in CMES (other than the Director) to provide information and coordinate visitor use of MMSC and other CMES facilities.

7. Identify additional housing for visiting scientists currently engaged in collaborative research projects.

8. Continue to support and fully utilize the advisory board for VI-EPSCoR's ICCE research component, which can then evolve into a standing external advisory board for CMES after VI-EPSCoR.

Beyond CMES

9. Clarify formal inter-unit relationships with respect to joint appointments and incorporate the mechanisms articulated into the University By-Laws.

10. Clarify IDC redistribution with respect to joint appointments.

11. Include CMES and DSM joint faculty in overall University strategic planning and capital improvement efforts concerning space, logistical and administrative support.

12. Continue to develop and implement the shared governance model and work to improve communications between the administration and faculty as much as possible.

In summary, the panel members believe that effective use of the resources provided to CMES through the VI-EPSCoR Phase II award offer the opportunity to significantly strengthen both the University's scholarly environment and its infrastructure. This is essential to enable UVI to achieve its stated mission to provide its students the best possible education and to achieve its vision "to become an exceptional U.S. institution of higher education in the Caribbean that can best serve the territory and its residents by enhancing the social and economic reform of the US Virgin Islands." (Vision 2012)

UVI's Center for Marine and Environmental Studies:

The Path Forward (July 2009)

Introduction

The Center for Marine and Environmental Studies (CMES) was established as a unit of the Research and Public Service (RPS) component of the University of the Virgin Islands (UVI) in 1999. In recent years CMES has seen significant growth in personnel, facilities, and research and teaching programs, assisted by financial resources provided by the Virgin Islands Experimental Program to Stimulate Competitive Research (VI- EPSCoR), a National Science Foundation grant program. The goal of VI-EPSCoR is to *"promote the development of the Territory's science and technology resources:*

- *By conducting research on areas of scientific inquiry linked to the Territory's economic development;*
- *By improving research infrastructure to strengthen competitiveness;*
- *By increasing participation of students in science and technology in order to build a skilled workforce; and,*
- *By building partnerships between government, non-governmental organizations, and the private sector to create a foundation of research and development for economic growth."*

By building productive collaborative relationships, encouraging original research, and improving support structure (facilities and policies), VI-EPSCoR complements the strong teaching elements that already exist at UVI, and is providing the resources required to move the University to the next level. Certainly in the natural and social sciences, but in virtually all other subject areas, students receive the best possible education and post graduate opportunities when they are personally involved in scholarly research. *As a result of VI-EPSCoR, CMES is now in a position to serve as a model within UVI with respect both to integrating research, teaching and public service, and also to providing research experiences and relevant apprenticeship/internship opportunities for students.* Thus, this model program represents a substantial opportunity for all of UVI.

Prior to the VI-EPSCoR initiative, the academic and the research and public service components of the university were largely separate. However, with VI-EPSCoR support, CMES has begun to synergistically combine those complementary university functions. It can and should serve as a model illustrating how these components of the university, by working together, can better serve the Virgin Islands. The mission of CMES is "to offer students and researchers a dynamic atmosphere to study tropical marine and environmental issues and increase awareness about marine topics in the VI." Its vision is "to develop an international center of excellence in tropical ecology for the Caribbean region that will make meaningful contributions to our present and future understanding of how marine and terrestrial ecosystems function, so that they can be managed effectively."

Institutional History

In 1962, the College of the Virgin Islands (CVI) was established. The first degrees awarded were associate degrees. In 1967, the institution added bachelor level programs and in 1970, the first bachelor degrees were awarded. In 1972, the institution was given land grant status by the U.S. Congress. In 1976, the first master's degree, a Master of Arts in Education, was awarded. CVI added Master of Business Administration and Master of Public Administration programs in 1978. As a result of its growing diversity of program offerings at the Master's level, the institution was renamed the University of the Virgin Islands in 1986.

CMES was created in 1999 by combining existing university elements (positions, programs or facilities) from both Research and Public Service (Eastern Caribbean Center; ECC) and Academics (Division of Science and Mathematics; DSM). Specifically, three elements from the ECC: (1) a research scientist position, (2) the Virgin Islands Marine Advisory Service (VIMAS, an extension program supported through NOAA UPR Sea Grant), and (3) a field station on St. John, VIERS (Virgin Islands Environmental Resource Station), were added to one element, the MacLean Marine Science Center (MMSC), which had been a part of DSM.

The MMSC facility is the administrative center of CMES, which is primarily a research enterprise. CMES faculty and staff have their offices and research laboratories in MMSC. However, MMSC is also serving many other important functions fundamental to the academic mission of UVI. The facility has not only offices and laboratory spaces but also classrooms and conference rooms. Courses for undergraduate and graduate degree programs are held there; the videoconference room is used for seminars, classes and meetings; student study space is provided in the computer lab; and, a number of DSM faculty members have offices in MMSC.

In 2000, the university appointed a part-time Director of CMES. CMES (jointly with DSM) now has an academic degree program, the Master of Marine and Environmental Science (MMES) that accepted its first students in Fall 2007, and awarded its first degrees in 2009. At this point, CMES combines teaching, research and public service functions, but in doing so it has yet to take full advantage of relevant capacities in other units of the university.

In June 2009, CMES had 20 personnel listed on its website (http://www.uvi.edu/sites/uvi/Pages/directory.aspx?s=RE&sectionCode=CMES). Three are CMES research faculty, 8 technical staff, 1 administrative staff, as well as 7 DSM faculty and one recent faculty joint appointment between CMES and DSM, the MMES graduate program coordinator. Eighteen of the personnel listed were interviewed; the other two were unavailable. However, in a stricter sense, CMES personnel actually include only the present CMES research faculty and supporting technical and administrative staff. It does not include the listed faculty from DSM in that none of those individuals report to the CMES Director, nor does he participate in their evaluations or assign them duties. The website does not even list other faculty and staff, who work closely with CMES staff on research, teaching and outreach activities, e.g., other faculty from DSM (e.g., chemists, physicists, computer scientists) working on related VI-EPSCoR research, CES staff (Cooperative Extension Service, e.g., extension agent) and a collaborating NOAA visiting scientist who is housed in MMSC.

The Director of CMES is responsible for the research faculty, technical and administrative support personnel, VIMAS (an outreach program that has space and personnel on both the St. Thomas and St. Croix campuses), as well as management of the MMSC facility on St. Thomas and oversight of the VIERS facility on St. John. The direct day-to-day operations and management of VIERS has been contracted to Clean Islands International (a non-profit) since 1997. The academic faculty housed in CMES and the teaching programs (B.S. in Marine Biology and the MMES) using MMSC facilities are the responsibility of the Dean of the Division of Science and Mathematics.

Role of VI-EPSCoR

In 2003, the Virgin Islands received a $4.1 million grant, the Virgin Islands-Experimental Program to Stimulate Competitive Research (VI-EPSCoR) from the National Science Foundation (NSF). Among other goals, EPSCoR grants are intended to establish academic expertise in a specified research topic. For VI-EPSCoR, this responsibility resided in CMES; the CMES Director served as the Principal Investigator (PI) of that portion of the grant whose overarching research theme was Biocomplexity of Caribbean Coral Reefs (BCCR).

The Phase I EPSCoR grant funded the addition of another research scientist to the CMES, much needed renovation of MMSC and VIERS, the purchase of laboratory and field scientific equipment, the development of the MMES graduate program (with DSM), and a number of small "seed grant" projects. These seed grants enabled a number of the DSM faculty to secure release time to develop their own research programs, most of which were collaborative efforts with scientists from other institutions. A number of publications and successful grant proposals have resulted from this research consistent with the overall goals of VI-EPSCoR to enhance research competitiveness.

These CMES accomplishments as well as significant additional achievements funded through VI-EPSCoR Phase I (e.g., instituting a new Master's program in Mathematics for Secondary Teachers, providing funding to support Graduate Program directors of both new Master's programs, and an upgrade in overall UVI Information Technology infrastructure) were instrumental in NSF awarding UVI a larger ($11.5 million dollar) EPSCoR Phase II grant in 2008. The research thrust for the Phase II grant, Integrated Caribbean Coastal Ecosystems (ICCE), evolved directly from the original BCCR theme, and again the locus (and the Principal Investigator) for the research portion of the EPSCoR grant is in CMES.

Evolution of CMES

Since its creation, CMES has grown from one to three dedicated research faculty members, the technical staff has more than doubled, administrative staff has been hired, the graduate population has grown to ca. fifteen students, adjunct faculty have been appointed and the facilities have been markedly upgraded both at MMSC and VIERS. Phase II VI-EPSCoR funding resources will allow CMES to add five new faculty (joint appointments with DSM), four new technical positions, two CMES laboratory spaces outside the MMSC, and continued improvements to the MMSC facility.

The Panel and its Approach

To help CMES develop a strategic plan to manage this continued growth, and achieve its vision of becoming a sustainable Center of Excellence, NSF funded VI-EPSCoR to engage an independent external expert panel to advise CMES (and UVI) upon:

1. Managing growth with respect to management, staffing, and infrastructure requirements;
2. Integrating research, teaching, and outreach;
3. Stimulating territorially-relevant research in the natural sciences; and,
4. Enhancing collaborations both within the territory and within the Caribbean

Our panel consists of three scientists who combined have extensive and complementary experience in teaching, research and administration at a variety of institutions (regional marine laboratories, oceanographic centers and academic institutions) with different governance structures (university, independent, government). The group has extensive familiarity with activities in the Caribbean and with international and national science programs, including EPSCoR (See Appendix A – Panel Members).

To gather the information required to provide useful advice, we conducted three site visits: (1) to interview CMES, other UVI staff and faculty (including higher administration) and to interact when possible with other VI stakeholders (territorial and federal government employees, NGOs) who may be or should be involved with CMES (Appendix B – List of Interactions); (2) to visit CMES field facilities on St Thomas and St. John; and, (3) to attend a planning workshop on an envisioned new field facility in St. Croix (joint government and university consortium). We also reviewed a number of documents supplied by the university (Appendix C – List of Documents).

We began to organize the results into a SWOT analysis (Strengths, Weaknesses, Opportunities and Threats), the usual strategic planning approach. In the end, what we learned and what we were charged with reporting upon was more appropriately expressed in a SCOR format (Strengths, Challenges, Opportunities and Recommendations).

This report provides a framework for CMES to craft and implement its strategic plan and recommends that the plan be developed within the next 9 months. Specifically, the report makes recommendations that focus upon issues that must be addressed to realize CMES' stated vision, and to capitalize upon its present strengths and opportunities. Our recommendations are organized with respect to the following timeline (and, to the degree possible, within each category in priority order):

- Immediate - these are actions that are critical to improving the way the unit is currently functioning and need to be addressed within the next year;
- Near-term - these actions need to be addressed in a 2-5 year time frame; and,
- Long-term - these are recommendations that should be addressed after the immediate and near-term issues have been resolved. Their time frame is 5-10 years in the future.

Where possible, we separate recommendations addressed specifically to CMES from broader recommendations to the University administration. Both need to be addressed for CMES (and VI-EPSCOR) to realize their full potential. Since perceptions do matter when trying to effect change, we have tried to capture the spirit of comments where we think a generally held perception may be standing in the way of progressive change or limiting the options available to move forward.

We provide a considerable body of information relevant to the development of a strategic plan for CMES in the Strengths, Challenges and Opportunities sections. However, we have confined our Recommendations to those items for which we can suggest specific feasible courses of action.

The resources provided to CMES through the EPSCoR Phase II award can significantly strengthen both the scholarly environment and the infrastructure of the University. To achieve UVI's stated vision to provide its students the best possible education (and subsequent employment opportunity), and to best serve the territory and its citizenry, it is essential to fully capitalize upon this opportunity.

Strengths

We recognized immediately that CMES already possesses many strengths. These can be effectively utilized to educate students and the general public about environmental issues, as well as to make significant contributions to the advancement of scientific knowledge and resource management. These strengths reside first and foremost in people, but also in location, in present programs and collaborations and in core facilities and support.

People

Undoubtedly the most important factor, critical to the success of any endeavor, is the quality of the personnel. CMES has grown substantially in the past decade, especially in the past five years. This could not have been achieved without the time and effort of key staff, as well as the contributions and cooperation of all impacted by these rapid changes. As noted above, these changes include new research and teaching programs, new staff, and improvements to both facilities and field operations (e.g., new oceanographic tools).

The CMES and DSM administrators, faculty and staff are highly motivated, committed and very well qualified academically with considerable relevant practical experience. We found them to be extraordinarily loyal to the institution; they also freely expressed their concerns about university policies and practices. We found them to be curious and dedicated, whether as teachers, as researchers, as technical support, as outreach personnel or as administrators. As a group, they clearly support one another and the goals of CMES, enjoy working together and with students, and, despite frustrations, they remain good natured and productive.

UVI senior administrators have generally positive views of CMES and have recently developed a number of relevant policies as part of the Vision 2012 process. These include joint

faculty appointments and an indirect cost return policy. These policies will benefit all units of the University, but are absolutely necessary for the growth and development of CMES.

Academic faculty members often carry full teaching loads. They are very serious about their efforts, and more broadly, about providing students the opportunity to grow and mature as scholars. The competing, yet complementary interests of teaching and research are proving difficult to balance administratively.

Most of the faculty members are interested in, and motivated by, the challenges of research. Many have formed collaborations with other research groups (e.g., territorial and stateside university and government labs). The CMES research faculty, as well as the DSM teaching faculty who have been supported in research through VI-EPSCoR funding, are actively encouraging and promoting these collaborative relationships.

The CMES technical staff, although limited in number, seems very competent and possesses a broad range of the complementary skills required to keep a field facility operating successfully. These skills range from supporting sophisticated deep diving operations to the electronic and mechanical expertise necessary to keep both laboratory and field based equipment functioning. In addition, they are approachable, capable of independent problem-solving, and engender confidence in their evident competence leveraged with personal enthusiasm.

We observed two formal components of outreach, the VIMAS program through Puerto Rico Sea Grant and the various education/outreach activities through VIERS. In both cases, the personnel seemed sincerely dedicated to serving the needs of the community, and despite limitations of resources, displayed considerable creativity in making the most of available resources.

Programs and Collaborations

CMES has a joint graduate degree program with DSM (Master of Marine and Environmental Science; MMES), and the MacLean Marine Science Center (MMSC) currently houses faculty who teach in the undergraduate Marine Biology and Biology programs. In addition to students in these programs, many other undergraduates take courses in the MMSC. This pool of students is a tremendous and essential asset that can be incorporated into research and outreach activities (as part of the broader teaching goal). Several staff spoke of undergraduates who became valuable research assistants through the informal but effective process of simply hanging around, asking questions and watching research activities. A pool of able and willing students among both undergraduate and graduate populations is available to contribute to the research, teaching and outreach activities of the CMES staff.

Grant programs at UVI geared to providing undergraduates research opportunities and career mentoring experiences include NIH MARC Scholars**,** NSF HBCU-UP Research Scholars, NIH MBRS-RISE Scholars, NSF SEAGEP Research Scholars**,** NSF HBCU-UP Summer Undergraduate Research Experiences**,** and NSF HBCU-UP Summer Sophomore Research Institute**.** Collectively these contribute to the Emerging Caribbean Scientists (ECS) program, which will be discussed further in a subsequent section. UVI has been alert to seeking out such opportunities and we highly encourage the continuation of this entrepreneurial approach. We

think that by building upon these programs and by establishing partnerships with other institutions, programs and individuals, that UVI will be able to successfully pursue additional competitive federal agency funding. While access to research opportunities and career mentoring is important for all students, it is especially relevant to provide pathways for minority students to pursue careers in science.

The graduate program, Master of Marine and Environmental Science (MMES), is in its initial stages with its first class nearing completion of the two-year program; its first degrees were awarded in the summer of 2009. A few research and teaching assistantships are in place, and some students are employees of local resource management agencies. In spring 2009, UVI was awarded a graduate STEM grant (NSF) that will provide additional funding to support 3 more students per cohort (6 in the two year program). The degree program's curriculum emphasizes field courses and an inquiry-based (e.g., research) approach to education, taking advantage of the living laboratory of land and sea that is the Virgin Islands.

Undergraduates (Biology and Marine Biology majors) are encouraged (in fact, required) to communicate, in a public forum, their scholarly efforts (e.g., senior seminar). Furthermore, faculty members have designed their courses to take advantage of the readily available field access at UVI. The MMES graduate students are strongly encouraged to investigate questions that will help address current territorial natural management concerns. An introductory science course for non-majors has also been created that is designed to engage students in multidisciplinary science and increase their understanding of natural hazards that threaten the territory (e.g., earthquakes, tsunamis, hurricanes). The concept of providing environmental educational experiences for all UVI students can lead to effective community involvement in environmental issues, and thus to sound environmental policy for the territory. CMES should continue to work collaboratively with other units of the university to build upon this very promising beginning.

As noted earlier, many of the CMES and DSM faculty members are collaborating with scientists from other institutions in both teaching and research. Other visitors come to pursue independent projects with little CMES input. Visitors include university and government scientists, as well as technical personnel manufacturing scientific equipment (e.g., on one of our visits, Autonomous Underwater Vehicles (AUVs) developed by a private company from Massachusetts were being field tested). Graduate classes from Yale (Forestry) and Harvard (Law School) have also visited CMES.

Memoranda of Understanding with UVI, directed specifically towards work with CMES, exist with Woods Hole Oceanographic Institution (WHOI), the University of Miami's Rosenstiel School of Marine and Atmospheric Sciences (RSMAS) and the USGS EROS program. UVI is a member of a consortium with University of North Carolina Wilmington (UNCW), Rutgers, University of South Carolina and the federal Department of Interior and Department of Commerce that is planning a field laboratory for Salt River, St. Croix. UVI is also a member of the DOI/Cooperative Ecosystems Study Unit (CESU) administered by the University of Miami. NOAA has a scientist permanently based at MMSC who actively collaborates with CMES scientists. CMES scientists also work with USGS and NPS researchers based in the VI (principally St. John, but also in St. Croix).

Other potential local collaborators include UVI faculty members and staff not currently engaged in CMES activities. Both the Academic (e.g., Divisions of Humanities and Social Sciences, Education, and Business) and Research and Public Service (e.g., Eastern Caribbean Center, Cooperative Extension Service) units contain faculty and technical staff, who could contribute to a broader Master's program and collaborate in interdisciplinary research and outreach programs.

A large external source of potential collaborators also exists in government (e.g., territorial and federal natural resource agencies), non-governmental (e.g., NGOs such as environmental associations), and private (e.g., environmental law; retired professionals in science and social science, engineering and construction management, and tourism) sectors. A mechanism exists to incorporate them formally into UVI as "community faculty," and of course, they could also contribute informally, e.g., through giving lectures or seminars. These groups could contribute significantly more to the teaching, research and outreach missions of CMES than they do at present.

Location

UVI is located in a US territory and has excellent access for travel to and from the US mainland, the Caribbean and Latin America. Although the Virgin Islands are small and in a sense remote, the supply line for goods and services is excellent, as are lines of communication. The local tropical environment is exceptionally diverse and is of great scientific and social interest. These factors, taken together, represent a significant strategic advantage because many sites where tropical ecological research is being performed do not have comparable access or comparable diversity. The opportunities provided by this "geographic advantage" should be capitalized upon.

The Virgin Islands constitute an exceptionally well-endowed natural laboratory. There are good examples of coral reefs, seagrass beds and mangrove forests, as well as ready access to oceanic depths within a short boat ride of the CMES laboratory facilities. The land-to-sea gradients contain good sites for comparative studies with heavily developed versus relatively pristine sites on each of the major islands (St. Thomas, St. John, and St. Croix). The islands are also located in a tectonically dynamic area, and in an oceanographic setting on the cusp between the Greater and Lesser Antilles that provide opportunities for addressing globally significant environmental issues.

The Virgin Islands are frequently visited by oceanographic research vessels, including government vessels (NOAA and EPA) and UNOLS ships (e.g., WHOI). In addition, St. Thomas is a major cruise ship destination. Many cruise operators are eager to offer more "green" tours; this too is advantageous to CMES. One of us (PBO) has been working closely with the cruise industry, and is well aware of the interest and opportunities therein and had previously initiated discussions with CMES personnel as to possible collaborations.

There are important databases on tropical ecology and geology (dating back to the 1950s) within the territory and significant recent additions to this knowledge base have been made by CMES scientists. There are other active research programs in the territory, including coral reef work, e.g., the coral reef research that dates back to the early '80s and continues today at the

Biosphere Reserve Center in St. John, and research on endangered sea turtles, bird and lizard species funded partially through the US Fish & Wildlife Service being conducted on St. Croix.

Facilities and Logistical Support

CMES has the following facilities and logistical support: two recently updated field facilities (MMSC and VIERS) that offer excellent support for field work, as well as moderate laboratory support; a diving program that includes a deep diving capacity whose staff contributes to running the recompression chamber located in the hospital on St. Thomas; a small fleet of vessels capable of supporting the current local and regional field efforts; and an ongoing collaboration with territorial and federal agencies monitoring territorial biological (coral reef) and oceanographic conditions.

Through efforts of VI-EPSCoR, UVI (and therefore CMES) will soon have full broadband and access to Internet2. The University's IT infrastructure has been recently upgraded and its service is continually improving. CMES faculty members also now have direct access to the MBL/WHOI library via broadband connection and the aforementioned MOU. Again, the availability of such facilities in a tropical location affords CMES a substantial strategic advantage over other Caribbean laboratories.

Challenges

The University of the Virgin Islands has matured significantly since its establishment as the College of the Virgin Islands in 1962. The progress has been remarkable in many areas, particularly in the institution's ability to enhance its delivery of quality academic programs. Quite naturally many challenges and obstacles remain. We emphasize at the outset that all universities have challenges, and virtually all of the types of challenges we identify below are shared broadly in the academic world. Smaller universities such as UVI, with predominantly teaching missions, typical face additional difficulties in providing a vital research environment.

Pace of Change

One of the greatest challenges faced is the rapid pace of change at UVI. Universities, and particularly the faculty and staff within them, are typically slow to recognize the need for, and accept, change. With the time-tested model of shared governance serving as the guiding principle for academia, change must be made through a slow and cumbersome consultative process. Any change perceived as top-down will be difficult to implement. On the other hand, "externalities" such as accreditation bodies, university boards, legislatures, alumni, the local community and other interests often demand quick action on the part of administrators.

The research emphasis and resources provided by VI-EPSCoR provides an internal impetus for change. Inevitably, to be timely, some changes must be instituted in a way that short-cuts the consultative process or may even test the principle of shared governance. This is a primary source of tension between university administrations and faculties.

With this as background, clearly UVI *has* changed, *is* changing, *will* change, and *must* change at a rate that is difficult for many on the faculty, staff and some administrators to accept. This presents a major challenge for any university administration to overcome, and the best way to do this, in our opinion, is to improve communications; to provide vigorous support of faculty governance; to involve faculty in administrative internships and fellowships on a term basis; and to keep faculty leadership fully apprised of developments as they occur.

The faculty and staff on the other hand, must appreciate that many external forces exist that a university administration must respond to, and they must work cooperatively for the common good with the administration to meet the challenges. While these issues are beyond the purview of this review, they are certainly important considerations because they have significant effects on the environment in which CMES and VI-EPSCoR function, and in a very positive sense, these institutional units can be particularly useful to UVI in dealing with these more general challenges.

Administration and Management

Faculty governance. The Middle States Commission on Higher Education, which is the accrediting agency for UVI, has identified faculty governance as an issue that must be improved at UVI. The faculty's obligation is to share governance with the Administration, and this obligation can only be met if there is an active faculty governance organization. The faculty must recognize its role in ensuring that both academic teaching and research programs are of the highest quality and this requires partnering with the administration. UVI recognizes the importance of this issue and is addressing it through the Vision 2012 process. Again, this is beyond the scope of this evaluation, except to say that CMES, along with the rest of the University will greatly benefit when this challenge is addressed.

Growth Implications. Through VI-EPSCoR and the success of the faculty at securing federal research funding leveraged by the VI-EPSCoR award, the research enterprise is growing rapidly. Research funding of this type had previously been only a minor constituent of the overall external funding secured by UVI. Most universities are challenged by the need to provide better pre- and post-award services (e.g., project accounting, procurement, hiring and timely billing) and UVI is no exception to this rule. Widespread concern exists in the faculty about hiring practices and the slowness with which human resources processes operate. Key faculty have been lost because the applicants were not US citizens or permanent residents and experienced problems with the United States Citizen and Immigration Service (USCIS). This is particularly unfortunate when the strongest candidates have been non-U.S. citizens. For CMES to be successful these difficult issues need to be confronted and such support services generally improved. With respect to CMES, this set of issues needs to be addressed not with generalities but by collaboratively identifying specific problem areas and assigning appropriate CMES personnel to work with appropriate university officials to address their concerns.

Promotion and Evaluation. Promotion and other evaluation processes greatly affect institutional performance and morale of all units, including CMES. Although UVI is in the process of integrating teaching and research faculty through joint appointments, in practice, there are currently two classes of faculty at UVI, a "teaching faculty" and a "research faculty." Although there is a process that specifically includes teaching, research and service in all

teaching faculty evaluations (the mandated annual Faculty Utilization Report: FUR), we were informed repeatedly that, in practice, the only truly important criterion has been "teaching." In contrast, the research faculty seems to have a more flexible process, and its members are to a degree being evaluated on all three aspects when they participate in outreach and teaching. These issues need to be directly confronted to fully realize the potential of the newly available "joint appointments" in furthering the teacher-scholar model (more on these topics to follow).

Administrative Training and Faculty Retention. The general problem of administrative training for faculty members, who come up the ranks and move into administrative positions, is a challenge at most universities. UVI has in the past taken advantage of the opportunity to have its faculty serve as "rotators" in federal service in Washington; this has clearly been of benefit and should be encouraged. Other mechanisms, such as ACE Fellows program are also available and should also be used. No formal mechanism or process presently exists to mentor new faculty (and administrators). This would help substantially with retention, and should be a high institutional priority.

Information technology. IT transition has been underway for a decade, but as is true in most universities remains a "work in progress." The IT area is one that received both high praise and criticism alike from faculty and staff, and many individuals may have high, and perhaps unrealistic, expectations. We understand that the University is transitioning to Internet2, which is remarkable for an institution of UVI's size. We ourselves had good IT support while at CMES, and we observed that broadband interactive video between CMES and the St. Croix campus was conducted routinely and with ease. Many much larger universities have been slow to adopt and support this useful communication technology, which relies heavily on IT services.

The appetite for IT support is enormous, but it is challenging and expensive to provide on a "24-7" basis. In our view it is good administrative practice to have a regular outside review of these services (as has recently been provided through VI-EPSCoR, and should continue through the University post-EPSCoR), because the most effective ways to both improve services and control costs may not always be obvious to permanent staff, who are focused on day to day service rather than long term improvement.

VIERS. VIERS has the potential to suffer with respect to routine maintenance and attention, as do all field facilities located at a distance from the main institution. Currently VIERS is managed by a contracted entity, Clean Islands International, which maintains the facilities and schedules activities. We were favorably impressed with the contract personnel and their dedication to success. At the time of our visit, the VIERS upland campus was being upgraded to a standard higher than observed during an earlier visit by one of our panel (EHG; 2002), and is certainly sufficient as a field facility. Through CMES and VI-EPSCoR efforts, the seaside laboratory has also recently been substantially upgraded, and is quite serviceable. While this contractual arrangement seems to be working at present for the VIERS facility, in the future as CMES grows (and space conflicts develop between teaching, outreach and research activities at VIERS), the arrangement may be less satisfactory. A more immediate challenge is the degree of utilization of VIERS by CMES faculty with respect to both teaching and research, as well as its potential use as a focus for developing programs that involve visiting scientists.

Organization and Staffing

Currently CMES has an Acting Director with 75% FTE of his salary for administration. The expectations of this position are to manage the day to day operations and personnel issues of CMES, represent CMES to other units of UVI, and represent CMES to external communities, including the territory and the national and international scientific communities. At present, these administrative roles already exceed a 100% FTE. As a result, it is virtually impossible to perform all these tasks as well as necessary much less leave sufficient time for research. The Director's position should be filled with a scientist who is recognized nationally and internationally for his or her scholarship, and is actively engaged in research. The Director should have overall responsibility for personnel, programs (teaching, research, and outreach), and two facilities (MMSC and VIERS). Most importantly, however, he or she needs to vigorously represent CMES to the "outside world." Presenting the achievements and the potential of CMES to the university, the territory, the region and to the national and international scientific communities is key to achieving recognized "excellence" for the Center. This task cannot be under-estimated given its time-consuming nature (including the necessity of travel) and its long term strategic importance to CMES and UVI.

To assist the Director, an Associate/Deputy Director needs to be appointed to deal with the day-to-day management of CMES staff and MMSC facilities and related issues including visiting scientists. This Associate/Deputy Director should have full authority in the Director's absence to focus on routine administrative matters in order to free the Director to focus on overall leadership of the program.

If CMES grows as planned with respect to faculty, staff and facilities, the sum of support UVI provides for the two administrative positions will have to grow to a 125%-150% FTE, presumably with the difference (50-75%) being funded by research grants and by teaching commitments.

In what sense DSM faculty members who are engaged in VI-EPSCoR funded marine environmental research or have offices in MMSC are in any real sense linked to or explicitly affiliated with CMES is not obvious. DSM faculty members who teach in the Marine Biology undergraduate major are listed on the CMES website but in no sense do these individuals have obligations to CMES nor do they report to the CMES Director. The DSM faculty members in other disciplines (e.g., Physics, Chemistry, Computer Sciences, and Mathematics) who may be engaged in VI-EPSCoR funded research are not credited as being part of CMES.

While organized research units (centers and institutes) such as CMES have developed within UVI, and some of the policies needed to structure and govern them have been initiated through the RPS Master Plan, this is not sufficient. For example, while there is a requirement in the Master Plan that each unit have a Strategic Plan – an important first step, UVI does not yet have a general definition or criteria with respect to forming, sustaining and dissolving such a research unit much less an agreed upon definition of what would constitute excellence in such a unit. In a real sense each of the present units is somewhat unique. The CMES facility itself (MMSC) was originally part of DSM, but as an organizational entity, CMES was created as research center under Research and Public Service. Clearer articulation about CMES'

organization and responsibilities is needed, as well as better communications at all administrative levels and amongst the general public to promulgate this information.

An active Advisory Board for CMES can create the opportunity for external stakeholders to provide overall guidance and direction for its programs. At present, there is no active Advisory Board for CMES. Fortunately, however, there was an advisory board for the VI-EPSCoR Phase 1 research thrust (BCCR), which is presently reconstituted for the Phase II research thrust (ICCE), and this board serves the same functions. There is also an advisory board for the MMES Master's program, a community advisory board for VIERS, and an AAUS diving safety board. Moreover, CMES is represented on the RPS Advisory Board. CMES must continue to be strongly represented on the RPS Board. Furthermore, after VI-EPSCoR when CMES is expected to be considerably larger, CMES will require some kind of Advisory Board. This is to ensure that external stakeholders will continue to have the opportunity to know and interact with CMES, provide valuable guidance, and help generate local political support as well as national scientific support for CMES' programs and facilities. The sustainability of CMES requires a board that fulfills these functions. Marine science, after all, is highly attractive to the public at large if it is presented to them correctly and systematically.

Academics

Science offerings and facilities. CMES and DSM have generally strong faculties and staffs with impressive competencies. However, although UVI has a highly successful and well-regarded Biology Program, faculty disciplinary diversity in biology, but even more so in the physical sciences, is limited by faculty numbers. We are informed that recent growth in demand with respect to science classes and majors is already stressing teaching faculty, as well as classroom and teaching laboratory resources. VI-EPSCoR resources have been helping already, and the anticipated addition of five joint faculty members (with DSM) will help even further. While CMES was established with a research focus in mind, in truth teaching and research are complementary and synergistic. They are vital to fulfilling the full academic mission of the University.

We heard concerns and ourselves observed that the teaching labs in St. Thomas could be utilized more efficiently (and be much better organized and administrated – e.g., managing shared use for research, teaching and service). Progress is being made in this regard but continued growth will be challenging. In contrast, VIERS has labs designed for specific functions but has yet to attract the degree of educational or research use we might expect.

Interviews with faculty indicated that there were significant challenges to fulfilling teaching responsibilities because of the limited number of faculty qualified to teach certain courses, and a recent increase in demand with respect to science courses and science majors. The official teaching load is 12 hours. However, science teaching overloads were frequently noted and some reported as being as high as and occasionally exceeding 18 hours. When a faculty member has an overload, especially 18 contact hours per week, not much time remains to perform quality research. Moreover, formal classroom teaching suffers, and those informal, yet critical, personal interaction times with students are virtually precluded.

The undergraduate Marine Biology Program in DSM remains fairly small and has few students from the territory. This is a challenge that needs to be dealt with directly and can be addressed by broadening the program scope through collaboration with CMES. Moreover, the opportunity to participate in CMES research can not only attract students into this program as a potential career track, but also active participation in marine biology classes by non-majors can significantly contribute to community environmental awareness. This, in turn, can lead to significant positive changes in local environmental policies.

Teacher-Scholar Model: better integration of research and teaching through joint appointments. Inasmuch as UVI is a small institution, the faculty will inevitably be challenged to meet teaching, research and service functions. To optimize success, there must be a close relationship between CMES research and DSM teaching functions. We believe that DSM is presently challenged to emphasize and support the research responsibilities of its faculty. Better integration with CMES through the available joint faculty option will help address this. A significant positive development has been the inclusion of this option in the new Faculty Manual. That said, the joint appointment is not sufficiently defined therein nor are the issues specifically addressed that need to be agreed upon to assure success.

Specifically, while a joint faculty member would presumably have a major and a minor administrative unit affiliation, what would be expectations and obligations of such a faculty member with respect to the minor affiliation? To what degree does a joint appointment between CMES and an academic unit imply that the research of the joint faculty member must be consistent with and contribute to the CMES mission? Under what circumstances would such a joint faculty member have special access with respect to the resources (e.g., office or lab space) of the minor affiliation faculty unit? Would both units participate in the evaluation of such individuals? What would differ in the appointment process of such individuals in comparison to appointments in individual units?

How can both units be appropriately involved in the review and approval process of proposals submitted to external funding agencies to assure that all the resources required will be made available and the actual costs incurred will be adequately compensated with respect to the units involved in the research?

A fair and equitable means of evaluation and promotion, taking into account research, teaching and service, must be implemented as soon as possible for these joint appointments. This requires joint evaluation by both DSM and CMES. Not every jointly appointed faculty member needs to allocate the same proportion of time to all three elements (research, teaching, service) but to the degree possible an allocation of effort needs to be agreed upon in advance and then fairly evaluated at the appropriate time.

DSM and CMES have already begun to collaborate in joint hiring and we strongly encourage this. However, the challenge we are focusing upon is spelling out these difficult issues in a transparent manner so that the joint appointment option can be implemented consistently and best support the fundamental missions of the respective units.

Undergraduate research. Undergraduate research plays a powerful role in enhancing the academic experience of college students. Undergraduate research engagement has already been significantly enhanced by Phase I of VI-EPSCoR through participation (more than 45 students) in seed grant research projects. It will be essential to build upon this in Phase II. Fortunately a mechanism exists to encourage this arrangement. The NSF and NIH student strengthening grants in the UVI Emerging Caribbean Scientists Program not only provide stipends to undergraduate researchers, but also support a faculty member to match students with appropriate projects and give support to the individual faculty mentors. A single designated faculty member should continue to serve as the laison between undergraduate students and potential CMES research opportunities.

While an annual event is held to honor UVI undergraduate research and some students present their research at international and national symposia, the University is not a member of the Council on Undergraduate Research (CUR), the premier national professional society that promotes undergraduate research. Joining this body will help to sustain undergraduate engagement in research. While there is an honors program at UVI, CMES is not yet actively recruiting the honor students to work with them on societally- relevant research and outreach activities.

Furthermore, UVI-NSF grantees could be regularly applying for Research Experiences for Undergraduates (REU) funds. Faculty members holding an NSF research grant are allowed through the REU program to add-on undergraduate assistants. CMES and DSM could also apply for an institutional REU that could involve UVI and collaborating faculty, working on one or more projects, supporting up to 10 students. This is an ideal summer program and could involve both UVI undergraduates and students from other institutions. CMES could also explore apprenticeship programs that involve 5-8 undergraduates, 1-2 graduate students and 1-2 faculty members that form a team approach to investigate a scientific problem (e.g., see http://depts.washington.edu/fhl/studentApprentice2009.html). NSF and foundation support can be sought to fund this type of program.

Establishing Undergraduate Internships with the territorial and federal funding agencies is also an important avenue to explore, as these experiences not only enrich a student's education, but also provide important gateways to career opportunities.

The advantages of continuing to enhance the undergraduate research emphasis are substantial. For example, it is likely that more Virgin Islands students will enter the UVI MMES program or go on to marine and environmental graduate studies elsewhere if they have exposure as undergraduates to CMES research. Moreover, as noted above with respect marine biology classes and programs, actual engagement in research will not only lead to career opportunities but equally importantly will contribute to the creation of an environmentally aware citizenry.

Research and Graduate Studies

Role of research. We heard many comments from faculty and staff alike about research in CMES and its wider role at UVI. Virtually everyone we talked to volunteered that CMES and UVI have potential to grow with regard to the research enterprise. However, as we indicated above, many DSM faculty members felt that their research contributions were under-valued, not

only with respect to annual performance evaluations but also general institutional recognition. **The failure to recognize research achievements in a palpable way has the undesirable effect of being a strong disincentive for undertaking research.** If there is one single item that impressed the review team the most, it was the fact that the balance between teaching, research and service is not clearly defined nor is it being well achieved at UVI.

F&A research incentive funding. While a new policy exists on F&A (facilities and administration – i.e., indirect cost) sharing, it is in its earliest stages of implementation and is thus poorly understood by many faculty members. Most universities use research incentive funding derived from F&A return to strengthen research infrastructure and provide administrative units and researchers with a flexible and fungible resource that can be used to foster more research activity. In the context of joint appointments, specific policies will have to be developed that do not presently exist. For example, absent a change any IDC return available would go to the major affiliation of a faculty member, whereas, it should be distributed equitably with respect to the level of research and administrative resources from a participatory unit that are required to support a specific research activity. When a policy for research incentive funding is initiated, it is also important that it be scrutinized closely to fit the criteria of enhancement of and re-investment in research capacity, and not be used as stop-gap funding to cover routine institutional expenses.

The graduate program. The graduate program, while off to a solid start, also needs to grow in student numbers to reach its full potential. It was designed to have 10 students per cohort, but has had fewer students enrolled in the first two years of the program (as was anticipated until it becomes better established). In fact, when the CMES faculty grows with the additional joint appointments and other UVI faculty members become joint appointments with CMES, more than 10 students per cohort can be enrolled. Critical mass in the graduate student population (particularly when it is one of the few graduate programs in the University) is important to achieving excellence. It is an appropriate strategy to accept several more students than 10 each year, as students are often applying to more than one institution, and, although offered a position at UVI, may choose instead to go elsewhere.

Recruitment of graduate students is always going to be challenge but one that is ongoing and will need to continue to be addressed (and staffed) in the future. At present it is being staffed through VI-EPSCoR, raising issues of "sustainability." Specific recruitment challenges include number of qualified applicants and number of local or regional applicants. Recruiting students to UVI is inevitably a challenge because it is a small institution not as well known as it should be outside the region. Within the Territory, the relatively small pool of students who might be interested either know little about CMES or have not been intentionally cultivated. This problem is the type of challenge that can be overcome with the advice and help of both the graduate advisory board as well as the ICCE advisory board, comprised of scientists at institutions throughout the country. Formal exchanges with mainland and Caribbean institutions will help, as will consistent efforts to distribute up to date informational materials at all relevant venues. Furthermore, another currently underutilized mechanism to advertise the graduate program is to ensure that all visiting scientists are made fully aware of the unique graduate programs (and also the undergraduate programs) available or being developed at CMES. This "word of mouth" advertising is facilitated by direct interaction with UVI students.

There are currrently limited formal interactions between graduate and undergraduate students except for the few graduate students who serve as Teaching Assistants (TAs). In most institutions, an essential part of graduate education is to assist the faculty in the undergraduate education process. At such institutions this is a mandated apprentice process for future educators and a practice that needs to be instituted in the MMES program.

Research facilities. Facilities while not well maintained are nonetheless serviceable. Deferred maintenance is clearly a big problem. Laboratories appear to be cluttered with no obvious organizational logic. Many laboratories have the appearance of being "common use" which has the disadvantage of meaning that no specific individual is responsible for their care and condition. We were told, and observed, that MMSC does not have but needs a suitably equipped machine shop. We did not observe a common "stock" room, but a secure stock room is essential to support both teaching and research (e.g., a stockroom to reliably supply frequently used field and laboratory supplies and equipment).

Plans are underway to address a number of these infrastructure deficiencies. CMES aims to structure its laboratories both within MMSC and outside it as "specialized service facilities" that can serve as cost recovery centers. These would be organized on a functional status and include a new environmental analysis lab and spatial analysis/applied statistics labs located on the UVI campus outside MMSC, and within MMSC, upgraded oceanography and ecology labs. In addition, plans are already underway to establish a field instrument storage area, to improve boat and dock facilities and to improve wet tables and seawater systems. The review team strongly endorses these actions.

Given this anticipated expansion and the present condition of the facilities, facilities management for MMSC must become better organized to get the most out of the limited space available. Security is also an increasing concern. For instance, we were told that the general purpose shop/construction area in the MMSC is chronically raided and pilfered, and thus few tools are available. We recommend that someone must be designated or hired as associate or deputy director of CMES to serve as the CMES facilities manager. This cannot be an ancillary duty of the CMES director who has leadership responsibilities that cannot be interrupted with day-to-day operational concerns of CMES. The deputy could be charged with other related responsibilities as well, such as facility scheduling, coordinator for visitors, serving as the safety officer to deal with OSHA and other safety concerns.

In fact, for CMES to function properly, specific individuals must also be identified and be responsible for the following: stockroom, shop, boats, dive program and VIERS. These do not necessarily have to be full-time positions, but the individuals who are changed with these responsibilities need be accountable and report directly to the CMES Deputy/Associate Director. Moreover, web-based operating procedure manuals need to be developed and kept up-to-date so that these individuals can be successful in these roles as can their successors.

Responsibility for the care and upkeep of each "shared" functional laboratory, e.g., oceanographic, ecology, environmental, spatial analysis, etc., also needs to be assigned to one technician and one faculty member. This would ensure their organization, equipment maintenance, and properly scheduled use. A report for each of these spaces listing what had

been accomplished, what problems were encountered and how resolved, and what are the goals for the following year, needs to be prepared and reviewed at specific time annually.

Space at MMSC is very tight: only 5,000 net assignable square feet (NASF). We were told that on the St. Thomas campus for science and math, including offices and labs excluding classrooms, the total is only 11,000 NASF. We gathered that currently there is not sufficient uncommitted laboratory space for new scientists when they come aboard, and that finding space for visiting researchers and students is practically a futile task. VI-EPSCoR already has funding for five more faculty members and four technical support positions in CMES. This activity, plus any increase in activity by visiting researchers will require additional space, as well as additional field support infrastructure. Indeed the allocation of space for visitors is already proving to be a challenge.

In the long run, we believe that improved use of space presently available will simply not suffice. The challenge will be to identify or create the required additional space if any significant expansion of faculty and staff is to occur.

Communications

Communications in this section refers to outreach activities by CMES, as well as promotion of collaborations with CMES activities within the university community and increasing awareness outside UVI of the research and educational opportunities at CMES – i.e., improved information flow with respect to the potential "users" of CMES services within and external to the territory.

Outreach. Several components of an outreach program exist. Puerto Rico Sea Grant's VIMAS is a long standing program. This currently active program suffers from a chronic lack of space, which we were told recently resulted in turning down a funding opportunity because there was no room for the personnel needed to conduct the work. Sea Grant is perceived to have been much more visible within the territory in the past and some individuals we interviewed expressed the desire that it attain its former prominence. An opportunity now exists to collaborate with existing outreach efforts through the Extension Service within the university. Although VIMAS is active within the VINE (VI Network of Environmental Educators), there appeared to be much less integration of other CMES activities (e.g., teaching and research) or personnel (faculty or students) with the outreach activities than we expected to find. This collaboration is essential to both groups.

VIERS hosts a number of educational activities that include local participants, but there was no evidence that there was any systematic accounting of these activities, or that they were included in the CMES assessment of annual achievements.

Public relations, marketing and recruitment of visiting scientists, visiting student groups, and visiting students. Two factors apparently account for the relatively low number of visitors:

- First, many researchers do not know that the CMES facility exists, and are unaware of UVI marine programs.

- Second, logistical support for visitors must be improvised since there is neither systematic management of such visitations nor allocation of resources for them.

The lack of affordable, safe, convenient housing facilities is one major problem. Another is that no laboratory space has been designated for visitors, and currently there is no organized process to inform visitors of opportunities, care for their housing and food needs, or care for other logistical needs. At present, visitor use is ad hoc, with each group being handled by whoever is available. Once a more formal process is established (and plans are currently underway to do so within CMES), CMES should consider summer programs, workshops and other activities that would attract the attention of others in the marine science community and the resident population of the Virgin Islands.

Opportunities

CMES is presented with a plethora of present and likely future opportunities which derive from its geographic context, its institutional context, the directions and priorities within the marine and atmospheric scientific community, federal agency funding mandates and priorities and the inherent importance of the coastal ecosystem to the territorial economy. The resources being made available through VI-EPSCoR will allow CMES to capitalize upon these opportunities to become, as envisioned, a regional and international center for tropical marine environmental research and education.

People

CMES has yet to take full advantage of the human dimensions science/policy linkages offered by other units within UVI (e.g., ECC, Cooperative Extension Service Extension; Division of Humanities and Social Sciences, etc.), and outside the university, local expertise within the territory. These represent both research and educational opportunities and these kinds of collaborations between natural and social scientists are essential to best serve the territory (see below).

Location

CMES' advantageous proximity to a range of coral reef ecosystems (from deep to shallow) with a range of conditions (from pristine to markedly disturbed) were discussed above as an inherent strength. The focus here is upon the research and educational opportunities this implies particularly because of their location in a U.S. territory and the parochial inclinations of federal agencies like NOAA, USGS, NPS, US F&W, USDA and the EPA. For example, NOAA/NMFS (National Marine Fisheries Service) is focusing increasing attention upon deeper reefs and reef complexes that constitute essential fish habitats (EFH), which are receiving increasingly explicit attention (and funding both internal to and external "from" NOAA to the academic community). CMES is well positioned to take advantage of this new perspective. A specific example of such an opportunity may be the NOAA NMFS and NOAA OAR (Oceanic and Atmospheric Research) interest in the spawning aggregations on the Grammatik Banks and other locations on the shelf edges of the VI. CMES already has a strong interest in and expertise

with spawning aggregation research. A similar argument can be made with respect to critical habitats (CH) as defined in the Endangered Species Act, the marine aspects of which are also a NOAA /NMFS responsibility.

The VI is home to a number of National (and Territorial) Parks and National Monuments (Department of Interior, National Park Service; DOI/NPS) and National Wildlife Reserves (NMR) with substantial marine assets (e.g., Buck Island Reef National Monument, Salt River National and Territorial Park, Green Island NWR, Sandy Point NWR, and East End Territorial Park on St. Croix; Buck Island and other bird refuges in St. Thomas; Virgin Islands National Park on St. John) which attract attention therefore from DOI scientists from the USGS and collaborating federal agencies with coral reef, other marine (e.g., birds) and threatened, endangered and introduced species interests (EPA, US F&W, and NOAA). These agencies often provide opportunities for students as interns, and also fund graduate research.

CMES scientists do and should continue to work with the VI government and enhance their collaborations with the agencies, universities and private enterprises that are using the coral reef ecosystems of the VI as test beds for advancing coral reef ecosystem and environmental science. For example, the EPA ship the R/V BOLD has conducted a series of monitoring cruises based out of St. Croix over the past few years. NOAA has made many oceanographic research cruises in the territory and plans to conduct a series of hydrographic mapping cruises in the coming year. Academic researchers are invariably welcome participants in such cruises (particularly those with local knowledge) and one can also envision using these expeditionary efforts as educational and outreach opportunities for CMES. UVI scientists have also worked with WHOI scientists on testing innovative Autonomous Underwater Vehicles (AUVs). This work leads to development and improvement of new technology, as well as providing baseline data for scientific studies.

Programs and Collaborations

The CMES focus within VI-EPSCoR is remarkably timely in light of the directions and priorities of the federal funding agencies. In this context the growing emphasis upon climate change science, hurricane research and integrated oceanographic observing systems is especially propitious. Aspects of climate change already being observed that are particularly relevant to the tropical coastal marine ecosystem are ocean acidification, sea level rise and increasing ocean temperatures.

With respect to all three, the U.S. scientific community is devoting increasing attention upon the Caribbean and naturally the federal agency focus is upon Puerto Rico and the USVI. Most recently this has been expressed in the context of the ARRA (American Reinvestment Recovery Act), the so called Stimulus Bill in NOAA's announcement of up to a $170 million in funding for projects such as ecological restoration and enhancements to community resilience to climate change. Overall all the science and natural resource agencies have been directed by the new administration to emphasize climate change in their research efforts (and extramural funding) and one can expect this to continue for at least the next four years (the remainder of VI-EPSCoR).

The Caribbean has been included as a specific regional area for development of an oceanographic observing system by the Integrated Ocean Observing System program (the so called CaRA-COOS). A recently retired member of the CMES faculty was one of the founding members of this nascent effort. Although limited funding has been made available to date, when further IOOS funds are available the regional associations will play a major role in how they are distributed within and across the designated regions.

"Integrated ocean observing systems" include not only observations themselves but also models. CMES has already begun to collaborate with UM/RSMAS modelers and has been more recently offered by the UM/RSMAS coordinator the opportunity to join in a five year NSF-PIRE (Partnership in Research and Education) proposal. The main objective is to implement an innovative prototype International Coastal Data Assimilation Experiment (ICODAE) by establishing an international partnership in ocean science research and education. The Caribbean would be one of the two basins being studied and the focus of U.S. partner efforts. Last, UVI through CMES has been given the opportunity to join an NSF Science and Technology Center proposal to improve hurricane forecast effectiveness and enhance community resilience to tropical storms that make landfall in the region.

The fundamental importance of the sustainable health of its coastal marine ecosystem including the coral reefs to the VI economy, and the fundamental emphasis at UVI upon issues relevant to the territory, constitute an enormous opportunity for CMES. This emphasis is reflective of the special relationship between UVI scientists and the territorial government with regard to the government's research and technical information needs. The Territorial Authorization Act provides that when government agencies, independent boards, etc. have need for a research project or study that cannot be accomplished within that organization by regular employees, they shall first seek assistance from UVI. The interest of the USVI government in its coastal ecosystem in particular was the underpinning for the recent (2007) memorandum of understanding between The Nature Conservancy whose USVI headquarters is established on St. Croix and the VI Department of Planning and Natural Resources with respect to assisting in the development of a territorial conservation strategy and action plan.

Moreover, the enormous attendance (over 500 residents) at a recent public meeting concerning development of a salt pond area on St. Thomas (Mandahl Bay) testifies to growing public attention to environmental issues. The Sea Grant extension agents imbedded in CMES, as well as the general science curriculum for non-majors and majors have the capacity to play a major role in enhancing environmental awareness throughout the territories. These CMES outreach personnel can also further the collaborative relationship between CMES and the relevant VI government agencies like DPNR and or federal agencies, e.g., the National Park Service by coordinating efforts with their outreach counterparts in the various government agencies as well as the non-governmental organizations like TNC.

Components of CMES (VIMAS) are active in the VINE (VI Network of Environmental Educators). Moreover specific funding opportunities are available at NOAA and other agencies for integrated CMES outreach/extension activities. From an educational perspective, the natural resource agencies, both territorial and federal, offer tremendous opportunities with respect to

experience in real world application of scientific information and a number of potential adjunct faculty members who could be directly engaged in the MMES and undergraduate programs.

While great progress has been made in formalizing collaborative relationships between CMES and mainland institutions (e.g., the signing of memoranda of understanding with WHOI and with RSMAS and membership in the CESU), further opportunities remain in this regard. As to formal relationships these include the possibility of similar memoranda of understanding with the University of Puerto Rico, other EPSCoR institutions like University of Rhode Island or The University of South Carolina, and the Florida public university system in the successor to the UM-NOAA Cooperative Institute for Marine and Atmospheric Studies. Joining such a cooperative institute would facilitate direct UVI access to NOAA research funding.

Potential collaborations and exchanges should also be sought with other Minority Serving Institution's marine science programs, and with other Caribbean institutions. For instance, UVI representatives have had some communication the University of the West Indies (Cave Hill), which hosts the Caribbean Large Marine Ecosystem Project (CLME). Another collaborative opportunity (given the focus of VI-EPSCoR) should be the Caribbean Community Climate Change Center (CCCCC). It is the official repository and clearing house for regional climate change data, providing climate change-related policy advice and guidelines to the Caribbean Community (CARICOM) Member States through the CARICOM Secretariat. In this role, the Centre is recognised by the United Nations Framework Convention on Climate Change (UNFCCC), the United Nations Environment Programme (UNEP), and other international agencies as the focal point for climate change issues in the Caribbean. It has also been recognised by the United Nations Institute for Training and Research (UNITAR) as a Centre of Excellence.

Another long range opportunity may be the proposed development of a scientific facility at Salt River, St. Croix. Under consideration is a National Park Service Facility to be co-managed and used by the university research community. UVI is a member of the university consortium supporting this effort. If and when it is completed, this would offer UVI a fully equipped marine laboratory on St. Croix in addition to its facilities in St. John and St. Thomas.

More significant and more immediate than any of these formal relationships may be the informal relationships that should develop from the regular use of MMES by investigators and class groups from mainland universities. A condition of any visit should be lecture offerings to the UVI MMES and undergraduate students and opportunities to interact with and share field, classroom and laboratory experiences with visiting students. Unfortunately this has not been the practice. It appears that most visiting scientists and classes have little interaction beyond the core CMES staff and leadership. Such interactions represent a tremendous opportunity with respect to both the research and educational aspirations of CMES.

Facilities

We noted in our visit to VIERS that the substantial outreach educational program was not being fully enough documented to be able to account for it when a CMES annual report is prepared. Similarly, the use of MMSC and VIERS facilities by external as well as internal

scientists, educational groups and outreach groups seems to be high at present, but these should be more fully documented, for use in future planning as well as present day accountability.

Recommendations

The first set of Recommendations that follow are the highest priority recommendations that require immediate (I) attention over the next year. Following these are a list of recommendations divided into near-term (i.e., 2 to 5 years; N) and long-term (beyond 5 up to 10 years; L). These are equally important to the long-term success and sustainability of CMES but either cannot (or do not have to be) addressed immediately.

In all cases we focus upon those actions most relevant to achieving the overall vision of CMES to become an internationally recognized regional center of excellence in light of its present strengths, the challenges faced and our analysis of unrealized (or insufficiently realized) present opportunities. To facilitate implementation we have separated recommendations referring to general University issues from those that are CMES-specific. Recommendations within each subsection are given, to the degree possible, in priority order.

Immediate Attention (I)

CMES Specific

I (1) Offer joint appointments to all DSM "teaching" faculty who wish to do ICCE related research using CMES resources, and all CMES "research" faculty who wish to engage in teaching activities.

New faculty hires (through VI-EPSCoR funding) are already envisioned as having joint appointments. However, this might "orphan" present faculty, i.e., both "research faculty" in CMES and "teaching faculty" in DSM. The concept of the teacher-scholar model has developed to the point that Joint Appointments are addressed in the new Faculty Manual. That said, this has not been defined and codified particularly with respect to joint appointments between research and teaching units. History and function have inter-twined the units, but the formal administrative relationships have not been carefully defined (see I-9).

I (2) Develop a CMES Strategic Plan as soon as possible. The first step is to undertake a critical quantitative evaluation of the present situation (including cost analysis) including staffing, programs, facility and field operations, visitors and collaborators, and opportunities and resources beyond VI-EPSCoR. The sequential steps to do this and an outline of what needs to be included are provided in Appendix E.

I (3) Clarify the organizational structure and reporting responsibilities within CMES with respect to services and facilities, and afford CMES a regular opportunity to provide comments upon and evaluate essential services provided to it by other units.

I (4) Appoint a CMES Associate/Deputy Director who has full authority in the Director's absence to focus on routine administrative matters in order to free the Director to focus on overall leadership of the program.

The Director's position should be filled with a scientist who is recognized nationally and internationally for his or her scholarship and would definitely have to continue an active research program. The Director should have overall responsibility for personnel, programs (teaching, research, and outreach), and two facilities (MMSC and VIERS). Most importantly, he or she would vigorously represent CMES to the University community, the territorial community and the national and international science communities. This task cannot be under-estimated given its time-consuming nature (including the necessity of travel) and its long term strategic importance to CMES and UVI. The Director needs to be a leader not simply a manager. An Associate/Deputy Director is needed for day-to-day management of CMES staff and MMSC facilities and related issues including visiting scientists

I (5) Develop and implement a space utilization policy and determine priority for office space in MMSC based on the extent to which the office-holder's activities are advancing the CMES mission.

I (6) Designate an individual in CMES (other than the Director) to provide information and coordinate visitor use of MMSC and other CMES facilities.

I (7) Identify additional housing for visiting scientists currently engaged in collaborative research projects (see N-13).

I (8) Continue and fully utilize the advisory board for the ICCE research component of VI-EPSCoR. This should evolve into a standing external advisory board for CMES subsequent to VI-EPSCoR.

Beyond CMES

I (9) Clarify formal inter-unit relationships with respect to joint appointments and incorporate the mechanisms articulated into the University By-Laws.

In doing so, the lines of authority, evaluation standards, and other issues related to personnel deserve particular attention. The expectations and obligations of such a faculty members and their contributions with respect to the missions of each unit will have to be specified. With respect to a joint appointment between a research and an academic unit the degree to which the research must be consistent with and contribute to the research unit mission will have to be specified as will the degree of access of joint faculty members to the resources of the units, how they will collaborate in the evaluation of such individuals and what will be their appointment process. Lastly, mechanisms will have to be developed to assure that both units are

appropriately involved in the review and approval process of joint faculty appointments as well as proposals submitted to external funding agencies.

I (10) Clarify IDC redistribution with respect to joint appointments

The challenge of implementing this policy should not be under-estimated. Doing so will represent a significant culture shift at UVI. Rather than the administrative unit, the key factor must be what resources are required to conduct research and where the actual costs will be incurred.

I (11) Include CMES and DSM joint faculty in overall University strategic planning and capital improvement efforts with regard to space, logistical and administrative support. Inclusion of the active resource dependent research community in such planning is essential to a sustainable research enterprise, which is at the core of what CMES offers UVI.

I (12) Continue to develop and implement the shared governance model and work to improve communications between the administration and faculty as much as possible.

Near-Term (N; 2-5 yrs)

CMES Specific

N (1) Develop an Implementation Plan to implement and fulfill the Strategic Plan. A critical element in this implementation plan will be a feasible, realistic and explicitly agreed-upon business model. Developing a realistic business plan will help recalibrate growth plans. It is essential to assure sustainability. See Appendix E.

N (2) Provide appropriate training to any faculty member being asked to move into an administrative position, for example, the Director and Deputy/Associate Director. This training may be obtained locally or arranged for off-island.

N (3) Consider developing a joint B.S. program in Marine and Environmental Science with DSM that could replace the current Marine Biology degree, and that would attract a great number of students and more local Virgin Island students.

N (4) Enhance mechanisms to ensure that visiting professors, researchers and students engage with MMES and undergraduate student bodies.

N (5) Make use of "virtual" research center organizational structures to engage and associate a wider group of faculty beyond DSM (e.g. - social scientists) in the CMES research enterprise. The National Coral Research and Education center (www.ncoremiami.edu) serves as a model in this regard and one with which CMES faculty is already familiar.

N (6) Actively recruit local NGO, VI government and federal government scientists, environmental managers and other relevant professionals to serve as community faculty. Encourage the participation of such individuals who may not wish to become community faculty in seminars, short courses and the provision of internship opportunities. This will provides an invaluable way to network creating a mutually beneficial future employment pipeline.

N (7) Develop summer programs, Jan term programs, workshops and activities that can attract undergraduate, graduate and post-doctoral marine scientists to CMES and thereby create a pipeline with respect to graduate (MMES) applications and collaborative research.

N (8) Expand the present visiting scholar program to encourage present and potential collaborators to engage in teaching activities and substantial interactions with the resident faculty and students.

Beyond CMES

N (9) The University must develop a formal policy on the structure and administration of organized research units (centers and institutes). This issue confronts and has been clearly articulated by many other universities, and the time is ripe for UVI to formulate such a document. This policy should provide not only information on the definition, designation and formation of such units, but should also address their operation, review and dissolution if necessary.

N (10) Every effort must be made to respect the Teacher Scholar Model. Teaching is highly regarded in the UVI culture and it must remain the highest priority. However, a way must be found to accord present academic faculty who wish to become joint faculty with a research unit teaching loads that provide sufficient time for research and outreach. Those teaching too many class hours simply do not have time to be engaged in scholarly research, continue to do a first class job in the classroom and informally interact with students outside the classroom setting.

N (11) Develop a formal mentoring program for new faculty and new administrators.

N (12) Continue to demonstrate science-based environmental leadership by providing the best possible objective science relevant to territorial environmental issues.

N (13) Develop sufficient on-campus summer (and year round) housing options. Limited on campus housing should also be sought for prospective visiting scientists. This should be included in the overall capital improvement plan.

Long-Term (L; 5-10 or more years)

CMES Specific

L (1) Expand collaborations with the national and international science community. This is an on-going recommendation and new partnerships and collaborations must always be sought and balanced against the availability of resources to support them.

L (2) Consider developing a Ph.D program with DSM when the MMES program, the joint appointments, the teacher-scholar model and the reputation of CMES as a regional and national center of excellence in the marine sciences are all well established. To do so effectively, CMES will need to broaden the faculty base of expertise. Developing such a program in conjunction with another institution of higher education, similar to the MBL-BUMP program, the WHOI-MIT joint program Ph.D. or MBL-Brown University Ph.D. program should be a model considered.

L (3) Establish a permanent Standing Advisory Board for CMES based upon the ICCE VI-EPSCoR advisory board. In doing so, consider staggered terms of appointment and a formal process of providing written recommendations and written responses to those recommendations.

Beyond CMES

L (4) Continue to build upon and develop federal funding opportunities available to UVI because of its' minority serving institutional status and its regional context. These should be regarded as a competitive advantage to be exploited as much as possible with regard to research, education and outreach activities in all UVI units (including CMES).

In summary, we believe that effective use of the resources provided to CMES through the VI-EPSCoR Phase II award offer the opportunity to significantly strengthen both the University's scholarly environment and its infrastructure. UVI will then be better able to achieve its stated mission to provide its students the best possible education and to achieve its vision "to become an exceptional U.S. institution of higher education in the Caribbean that can best serve the territory and its residents by enhancing the social and economic reform of the US Virgin Islands." (Vision 2012)

Appendix A. Panel members

Together, Drs. Gladfelter, D'Elia and Ortner bring to this effort a wealth of relevant professional experience and highly complementary interdisciplinary scientific expertise. All three have personal experience in the Virgin Islands, with Drs. Gladfelter's and Ortner's being extensive; Drs. Gladfelter and D'Elia are intimately familiar with EPSCoR programs with Dr. D'Elia having served in reviewer or advisory roles for other programs elsewhere. Drs. D'Elia and Ortner also served together in the Oceanographic section at the National Science Foundation as the directors of Biological Oceanography and Special Programs, respectively, and Dr. D'Elia as director of a Sea Grant Program for a decade.

P.B. Ortner

Dr. Peter Ortner joined the University of Miami's Rosenstiel School of Marine and Atmospheric Science as a full-time faculty member in 2007 after a thirty year federal career at NOAA's Atlantic and Oceanographic Laboratory (AOML) during which he served as an adjunct faculty member at both the Rosenstiel School and the Law School. As such he has been active in both the undergraduate and graduate programs both in the classroom and as a mentor/advisor to a series of graduate students and post-doctoral investigators. He has had numerous research grants from the National Science Foundation, the Office of Naval Research, NASA, NOAA, the USACE, the state of Florida and other agencies. He has served a panelist and reviewer to numerous federal and state research programs and agencies. As Chief Scientist at AOML he was responsible for a substantial federal research facility with vessels, aircraft and autonomous vehicles (both oceanographic and aircraft) and high performance computing.

He has served as the Chair of Ship Operations at RSMAS for more than a decade and for the past six years as an Operator Representative and member of the Executive Committee of the UNOLS who direct the nation's research fleet. His laboratory at AOML has maintained a long term presence in the Virgin Islands through its CREWS/ICON station at Salt River, St. Croix, and Dr. Ortner has personally visited more than a dozen times and conducted a year-long experiment at the site on demersal plankton associations with the coral reef. For the past two years he has been the overall program manager for large-scale pan-Caribbean Global Change Science research program (focused within the U.S. Virgin Islands upon coral reef protected areas in collaboration with the territorial government, non-governmental organizations and the National Park Service) that is funded by a multi-national corporation based in St. Croix. UM/RSMAS is an active member (and Dr. Ortner the official representative) to both CaraCOOS and to the Association of Marine Laboratories of the Caribbean (AMLC) in both of which CMES faculty are playing a lead role.

C.F. D'Elia:

Dr. Christopher F. D'Elia joined the University of South Florida St. Petersburg in 2005 where he has appointments as Professor of Environmental Science, Policy and Geography and Associate Vice Chancellor for Research and Graduate Studies. He has also served as Interim Vice Chancellor for Academic Affairs (Academic Year 2007-2008) on that campus. Prior to that he was jointly appointed as Professor of Biological Sciences and Professor of Public Administration and Policy at the University at Albany, SUNY, where he also was Vice President for Research and SUNY Research Foundation Operations Manager. Before joining UAlbany, in 1999, he was a Professor at the Chesapeake Biological Laboratory, University of Maryland Center for Environmental Science and Director of the Maryland Sea Grant College Program of the University System of Maryland for ten years.

Dr. D'Elia has held numerous research grants and has authored or coauthored over sixty scientific publications on the nutrient dynamics of estuaries and coral reefs, and on science policy. He is a Fellow of the American Association for the Advancement of Science and has served on numerous advisory panels to the National Science Foundation and other federal, state and private funding agencies. Dr. D'Elia has considerable experience as a panelist, reviewer and advisor, to federal agencies including NSF, NASA, NOAA and USDI. This includes his service as a member on several Program Assessment Teams for the National Sea Grant Program (Texas and Louisiana). He has served as a panelist or reviewer for Maine, Kansas and Delaware EPSCoR's over the years, but particularly as an advisor to the AAAS Research Competitiveness Service for the past three years on the latter two programs.

E.H. Gladfelter

For more than 30 years, Dr. Gladfelter has engaged in marine science research, teaching and administrative activities. Her professional interests include biomineralization, symbiosis, and coral reef ecology, as well as coastal management and environmental policy. From 1974 until 1990, she worked at West Indies Laboratory (WIL), St. Croix, the final years as Director. She was actively involved in research efforts of the US National Park Service, contributing to the first mapping and descriptions of Buck Island Reef National Monument, and the potential British Virgin Island marine parks. Other research was funded primarily through the NPS and the NOAA- UPR SeaGrant program. She taught a number of field courses at WIL and helped develop a Coastal Management Semester program in addition to the Marine Science semester. Developing the undergraduate program led to numerous visits to college campuses (>60) to give seminars, and the development of formal agreements with a number of these institutions. As PI of a number of NSF facilities proposals, she helped increase the research capacities of WIL. More recently she has been working with the University of the Virgin Islands in several different capacities to help develop their marine science program. Initially, she advised UVI on the renovation of VIERS. She prepared a feasibility report for the establishment of a MS program in Marine and Environmental Sciences; this program began in Fall 2007, and she serves on its advisory committee. She also served on the Advisory committee for the research component of the first VI-EPSCoR grant (BCCR) and participated in the presentation of the achievements of the first VI-EPSCoR program at NSF in Fall 2007.

For the past 11 years, she has been a guest investigator at the Marine Policy Center at Woods Hole Oceanographic Institution. Her interests include policy decisions affecting individuals and institutions engaged in field science research and teaching; she has written *Agassiz's Legacy: Scientists' Reflections on the Value of Field Experience* (Oxford U Press, 2002). She also continues biomineralization research and teaching field courses (Shoals Marine Laboratory). Throughout her career, she has serve on local and regional policy and regulatory boards and commissions.

Appendix B. UVI Adminstrators, Faculty and **Staff**
(and others) **contacted** for this report

Name	**Position**	unit	office
Ragster, LaVerne	President	UVI	
Musah, Al Hassan	Provost	UVI	
Smith, Henry	VP for Research and Public Service	UVI	
Lewis, Lawrence	Ass't to VP RPS	UVI	
McKayle, Camille	Dean, DSM	UVI; DSM	
Lord, George	Dean, HSS	UVI; HSS	
Idrisi, Nasseer	Acting Director; Res. Asst. Prof.	CMES; EPSCoR	MacLean MSC
Nemeth, Richard	Reseach Assoc. Prof.	CMES; ICCE P.I.; EPSCoR	MacLean MSC
Smith, Tyler	Res. Ass't Scientist	CMES; EPSCoR	MacLean MSC
Jobsis, Paul	Assoc. Prof. Biology, Chair, Biology	DSM; CMES; EPSCoR	MacLean MSC
Hall, Richard	Prof. Biol.	DSM; CMES; EPSCoR	MacLean MSC
Nemeth, Donna	Asst. Prof. Biol.	DSM; CMES; EPSCoR	MacLean MSC
Ratchford, Steve	Assoc. Prof. Biol.	DSM; CMES	MacLean MSC
Turner, Theresa	Prof. Marine Biol.	DSM; CMES; EPSCoR	MacLean MSC
Waddell, Kim	MMES Graduate Prog. Coordinator	CMES; EPSCoR	
Joseph, Charmane	Administrative Assistant III.	CMES	MacLean MSC
Noori, Lihla	Extension Specialist II, VIMAS	CMES; EPSCoR	MacLean MSC
Prosterman, Stephen	Diving & Marine Field Officer.	CMES	MacLean MSC
Brown, Kevin	Research Specialist II.	CMES; EPSCoR	MacLean MSC
Kadison, Elizabeth	Research Analyst I	CMES; EPSCoR	MacLean MSC
Blondeau, Jeremiah	Research Analyst I	CMES	MacLean MSC
Calnan, Jacqulyn	Research Analyst I.	CMES	MacLean MSC
Pittman, Simon	NOAA Visiting Scientist		MacLean MSC
Taylor, Marcia	Extension Specialist II, VIMAS	CMES; EPSCoR	STX
Tyner, Emily	Research Analyst I, VIMAS	CMES	STX
Brown, Kerry A	Asst Prof, Biology, MMES	DSM; EPSCoR	
D'Andrea, Anthony	Biologist, MMES	DSM; EPSCoR	MacLean MSC
students 1st yr	MMES	CMES	
Smith, Dave	Physics	DSM; EPSCoR	
Boumedine, Marc	Computer Science	DSM; EPSCoR	
Archibald, Thomas G	Visting Assoc Prof Chemistry	DSM; EPSCoR	
Latesky, Stanley	Assoc Prof Sci; Ch Chemistry	DSM	
Thomas, Toni	Extension Agent II	CES; EPSCoR	
Whitaker, Meri	Director	EPSCoR	
Drayton, Nicolas C	Program Coordinator	EPSCoR	
Caines, Karema S	Admin Asst	EPSCoR	
Prentice, Kaisa L	Program Spec I	EPSCoR	
Watlington, Roy	Retired Prof. Physics	DSM	
Drost, Don	Retired (&Visting)Prof. Physics	DSM	
Ray, Gary	Visiting Assoc Prof Biology	DSM	MacLean MSC
OUTSIDE UVI			
Aaron Hutchins	Director, STX office	The Nature Conservancy	
Kemit Lewis	brief encounter	DPNR; CZM; STX	
Bob Mathes	(unable to make meeting)	Commisioner, DPNR	
Clayton Jones		Webb Engineering	
Doug Webb &others	Field Manager, VIERS	Clean Islands, Inc	
Carol Burke	Program Manager	STX Environmental Assoc.	
Zandy Hillis	Resource Manager	NPS, BIRNM	
Michael Bayer	Planner	new marine facility; STX	
Bob Rohr	VP Research	UNCW	
Bob Wicklund	Coordinator new Marine Lab - STX	UNCW	
Karen Koltis		US Dept. of Interior	

Appendix C.UVI documents consulted for this report

Vision 2012, UVI strategic plan- online at http://strategicplan.uvi.edu/

Framework for Excellence. Master Plan 2007-2012. Developed by the Research and Public Service Component Units.

University of the Virgin Islands: Information & Technologies Services Infrastructure Assessment. Final Report (Revision 2.0). December 17, 2008. Prepared by cgnet.com

Faculty Policy Manual. Approved by UVI Board of Trustees, November 1, 2008

A Survey on UVI Faculty Satisfaction. Prepared by the Eastern Caribbean Center of the University of the Virgin Islands. January 15, 2009

Proposal for the Master of Science Degree in Marine and Environmental Sciences. A report prepared for the Division of Science and Mathematics and Center for Marine and Environmental Studies, University of the Virgin Islands by E. H. Gladfelter, Ph.D. February 2006

VI EPSCoR documents (by date)

EPSCoR Strategic Plan April 28, 2005
EPSCoR Annual report Year 4

Reverse Site visit report from NSF Nov 14, 2007

Response to the U.S. Virgin Islands Reverse Site Visit Report (Award Number EPS-0346483, Reverse Site Visit Date 6 September 2007)

RII Proposal EPS-0814417 entitled "Virgin Islands EPSCoR: Building Research Strength in the US Virgin Islands

NSF queries on EPS-0814417 entitled "Virgin Islands EPSCoR: Building Research Strength in the US Virgin Islands (Mar 3, 2008)

Response to Issues Identified By the Merit Review of Proposal EPS-0814417 Entitled "Virgin Islands EPSCoR: Building Research Strength in the US Virgin Islands" 17 March 2008 plus APP A&B

VIRGIN ISLANDS EPSCOR STRATEGIC PLAN. 10 March 2009

Executive Summary for VI-EPSCoR March 16, 2009

Other: VIRGIN ISLANDS RESOURCE CONSERVATION & DEVELOPMENT COUNCIL, INC. 2008 – 2012 AREA PLAN

Appendix D. ACRONYMS
USED IN THIS REPORT

within UVI

BCCR	Biocomplexity of Caribbean Coral Reefs (EPSCoR I research thrust)
CES	Cooperative Extension Service (RPS)
CMES	Center for Marine and Environmental Studies (RPS)
ECC	Eastern Caribbean Center (RPS)
ECS	Emerging Caribbean Scientists
DSS	Divison of Humanities and Social Sciences
DSM	Division of Science and Mathematics
ICCE	Integrated Caribbean Coastal Ecosystems (EPSCoR II research thrust)
MMES	Master of Marine and Environmental Sciences
MMSC	MacLean Marine Science Center
RPS	Research and Public Service
VI EPSCoR	Virgin Islands EPSCoR
VIERS	Virgin Islands Environmental Resource Station
VIMAS	Virgin Islands Marine Advisory Service

External

CaRA-COOS	Carribbean Regional Association Coastal Ocean Observing System
CESU	Cooperative Ecosystems Study Unit (DOI)
DOI	Department of Interior (US)
DPNR	Department of Planning and Natural Resources (VI)
EPA	Environmental Protection Agency (US)
EPSCoR	Experimental Program to Stimulate Competitive Research (NSF)
EROS	Earth Resources Observation and Science
IOOS	Intergrated Ocean Observing System
NIH	National Institutes of Health (US)
NOAA	National Oceanic and Atmospheric Adminstration (US)
NMFS	National Marine Fisheries Service (NOAA)
NPS	National Park Service (DOI)
NSF	National Science Foundation (US)
OAR	Oceanic and Atmospheric Research (NOAA)
TNC	The Nature Conservancy
RSMAS	Rosenstiel School of Marine and Atmospherice Science (UM)
UM	University of Miami
UPR	University of Puerto Rico
USDA	US Department of Agriculture
US F&W	US Fish and Wildlife Service (DOI)
USGS	US Geological Survey
VINE	Virgin Islands Network of Environmental Educators
WHOI	Woods Hole Oceanographic Institution

Appendix E – Strategic Planning Processes and Sequence

CMES needs to develop a strategic plan, and we are providing options, analyses and general recommendations based upon our experience at other institutions that will facilititate that process. For a strategic plan to be developed:

A. There must first be a critical quantitative evaluation of the present situation (including cost analysis) including inter alia the following:

- Staffing
  - Who is the CMES staff?
  - Who is currently available to serve what additional functions? -
- Programs
  - What teaching, research and outreach programs currently exist?
  - How much faculty and staff time is devoted to each activity?
- Facility and Field Operations (vessels and scuba) utilization
  - Detailed operations and maintenance costs
  - What is currently available?
  - What assets are being used for research, for teaching and for outreach
- What is the laboratory and office utilization at present?
- What part of these facility and field operations costs are being provided through research grant funding (VI-EPSCoR and other) and what part are being provided to CMES by UVI?
- What are the actual costs and benefits of external visitors and research collaborators
- What is the feasibility of opportunities/resources beyond VI-EPSCOR (see Opportunities section above) and when these might become available.

B. Only with this report and the above quantitative assessment in hand is CMES ready to develop its strategic plan and it needs to begin to do so as soon as possible. Recognizing that present facilities must be expanded to fulfill the vision of CMES and EPSCoR, the elements of such a plan would then include what additional resources such as vessel number and type, laboratory space, instrumentation, technical support, etc. are required, what level faculty should be recruited and what is expected of them, e.g., their degree of participation in undergraduate and graduate programs

Part of the strategic plan must be a clear understanding of priority of facility and equipment use with internal teaching, research and outreach needs accommodated first (and adequately provided for in the UVI budget) and second external visitor needs. The plan needs to also reserve some use of space and equipment for exploratory, unfunded staff research to nurture future research funding.

If there is additional teaching capacity (provided by the new joint appointment hires) the plan needs to factor in the degree to which this will release those present DSM faculty who wish to engage in more research. It must clearly specify what further resources are required to support more extensive external collaboration.

Most critically of all, it must consider the degree of growth that can be sustained beyond the stimulus being provided through VI-EPSCOR. To do this it is essential to reach some preliminary agreement amongst all stakeholders (CMES, DSM and others in UVI) upon an appropriate upper capacity for all activities (teaching, research, and outreach).

Accomodating growth already being planned for CMES will require additional space. Greater efficiency of use and reallocation may provide some relief however it is a virtual certainty that new construction will be required. This implies a capital campaign; including other natural and social sciences units at UVI should be part of the strategy.

C. Once a strategic plan is developed, the next step will be an **Implementation Plan** to accomplish the strategic goals, but an implementation plan is not an immediate goal. Doing that properly and in sufficient detail should be a near-term goal not an immediate one.

Such a plan needs to be detailed with regard to actions required, assignments of responsibility, a realistic timetable, accurate identification of the costs (immediate and long term) of the actions contemplated and identification of specific sources for the resources required to implement the plan. This plan will encompass inter alia:

- Staffing
- Programs (research, teaching and outreach),
- Facilities and Field Operations at all locations (e.g. MMSC, VIERS and possibly STX)
- External Interactions (visiting scientist and student utilization of CMES facilities)

Such a plan will assign specific actions to specific groups or individuals and provide appropriate timelines and milestones so that progress can be tracked.

A critical element in this implementation plan will be a feasible, realistic and explicitly agreed-upon business model. Specifically, what level of support (for what functions and facilities) will be committed by the University, and what level of support will have to be garnered from external sources? After VI-EPSCoR, what external sources (at what level) will be relied upon to support CMES? How dependent is CMES growth upon a successful capital improvement campaign? What steps will be taken (and what resources committed) to maximize the chance of success in such a campaign?

Developing a realistic business plan may well serve to recalibrate growth plans and may result in changes to the underlying strategic plan. A realistic business plan is absolutely essential to assure sustainability.