

**VIRGINIA INSTITUTE OF MARINE SCIENCE (VIMS)
2023 SIX-YEAR PLAN NARRATIVE (Part II)**

SECTION A: MISSION & PRIORITIES

Key question: What are your institution's unique strengths and how do those inform your strategic priorities?

A1. What is your institutional mission? Please share any plans you have to change your mission over the six-year period.

The Mission of the Virginia Institute of Marine Science is to seek and broadly communicate knowledge in marine and coastal science to the Commonwealth of Virginia, the nation, and the world through research, education, and advisory service.

As a premiere, globally recognized coastal and marine science institute that is integral to decision-making in the Commonwealth, our mission remains the same but our focus and commitment to excellence have been enhanced by the development and implementation of a new strategic plan. Moving forward VIMS will be more directly focused on major challenges facing coastal communities in Virginia and around the nation and world through solutions-based research and discovery in the areas of:

- science for the stewardship of natural resources;
- ensuring ecosystem health; and
- developing and maintaining resilient coastal communities.

In so doing we will continue to be the trusted partner to state and federal agencies and the private sector as we translate our research findings into advice and solutions for decision and policymakers. And we will remain a leader in the production of the next generation of scientists, educators, problem solvers, and managers through education and training of unsurpassed quality.

A2. What are your institution's greatest strengths and areas of distinctiveness that it should continue to invest in? What are your institution's greatest opportunities for improvement?

As one of the nation's largest and most respected marine science institutes, VIMS is well positioned to stay at the leading edge of scientific production; we have some of the most talented and well-recognized scientists in the country on staff and we've recently

added outstanding new scholars to replace expertise lost through retirements. VIMS is distinctive in its design, serving as both a state agency and a professional school of a leading liberal arts university. Two significant advantages should be emphasized:

1. Our focus on actionable science that directly addresses the needs of our stakeholders and constituents; and
2. Our expertise in – and commitment to – coastal and estuarine dynamics, which separates us from many of our peers and competitors who tend to be focused on deep ocean issues. This is particularly advantageous because most of Virginia’s – and much of the global – population is coastal, positioning VIMS to be at the leading edge of science that is responsive to the needs of stakeholders and citizens.

As for improvement, we have the capacity to broaden and deepen our ability to produce actionable science and advisory service needed by the wide range of Commonwealth agencies, citizens and stakeholders we serve. That need will only grow and broaden in the years ahead, and with appropriate support we are poised to answer the call.

A3. What are the top 3-5 strategic priorities you are currently pursuing or planning to pursue in the next six years? Please explain how each strategy relates to the strengths and/or opportunities for improvement mentioned above and will ultimately drive better outcomes for students.

1. Center of Excellence in Environmental Forecasting

The proposed Center of Excellence in Environmental Forecasting (CoEEF) would leverage unique expertise and resources at VIMS to establish a world-class environmental forecasting center and directly address the (growing) needs of the Commonwealth and the lives of approximately 5,000,000 Virginians who live in coastal areas of the state. Specifically, the CoEEF would:

- Help vulnerable coastal communities adapt by applying novel, next-generation simulation models and state-of-the-art science connected to coastal and estuarine processes to solve the most pressing issues facing coastal communities – today and in the decades ahead.
- Target sea-level rise, shoreline erosion, storm events and storm surge, flooding, hypoxia, ocean acidification, and water quality associated with harmful algal blooms, with the flexibility to expand focus areas as the Center grows through new research funding and philanthropy.

- Significantly advance our understanding of complex coastal systems and facilitate collaboration and innovation opportunities for researchers, while also providing advanced training for the next generation of scientists and policy makers.
- Establish Virginia as a global leader in environmental forecasting in coastal and estuarine systems, attracting additional investment from outside the Commonwealth.
- Improve our ability to not only forecast, but rapidly and effectively respond to emergency situations in partnership with state agencies such as the Department of Health and Human Services, Department of Transportation, the Virginia Marine Resources Commission, and others.

We seek funding for scientific personnel and computing resources necessary for data collection and analysis, model development and translation, and the building of tools and resources for policy and decision makers.

2. Sustain VIMS' World-Class, Advanced Breeding Program for Shellfish

Virginia is a national leader in aquaculture production of clams and oysters. These developments have been rooted in scientific advances and transfer of contemporary technologies to the industry by VIMS. In fact, VIMS has become a world leader in shellfish aquaculture technologies. Advances made by VIMS in this area include:

- Development and maintenance of disease-resistant, fast-growing oyster strains and tetraploid oysters used by industry to produce sterile triploid oysters that can be marketed year-round.
- Development of advanced genomic selection technologies that will further revolutionize our ability to produce even better strains of oysters.
- Heavy support of Virginia's oyster aquaculture industry due to the use of these selected oyster strains and VIMS' ability to continually develop improved strains.

We seek funding to ensure that industry can further operationalize the advances mentioned above and maintain national and international leadership in this valuable industry.

3. Tracking Saltwater Intrusion in Coastal Virginia

Across the Chesapeake Bay, watershed encroachment of tidal marshes have resulted in the loss of approximately 80,000 acres of coastal forestland and 20,000 acres of farmland since the mid-1850s. The regional sea-level rise (SLR) rate is a predominant driver; however, Virginia is a hotspot for land conversion because rapid land subsidence and a gently sloping coastal plain result in large areas of tidal

inundation. In particular, the flat, low-lying areas near the mouth of the York River and the Virginia Eastern Shore have rates of land conversion that are among the fastest in the nation.

With this priority, VIMS seeks additional funding to provide the following results:

- Utilization of high-resolution, commercial-grade satellite imagery coupled with ground-based monitoring to annually track forest and farmland loss in Virginia due to saltwater intrusion.
- Improvement of forecasts of future land conversion.
- Development of mitigation strategies.
- Quantification of the number of new acres of wetlands created by sea-level rise.
- Identification of the conditions that lead to successful marsh migration versus failed migration (i.e., forest loss without marsh development due to insufficient tidal connectivity).
- Quantification of the net radiative balance (carbon sequestration and greenhouse gas emission) during land conversion.
- Exploration of carbon-offsets as a market-based solution to funding coastal resilience projects.

4. Establish Virginia Harmful Algal Bloom (HAB) Monitoring Consortium

Harmful algal blooms pose a significant threat to human and animal health, as well as to aquaculture, commercial fisheries, aquatic food webs and safe recreational water use. Recent increases in the frequency, severity and distribution of algal blooms have occurred worldwide and the threats posed by emerging HAB species are predicted to increase. Specifically, in Virginia's waters there are emerging HABs, as well as increases in the severity and distribution of several harmful species. Additional coordinated and intensive monitoring efforts are needed to gain a better understanding of the conditions that lead to blooms of HAB organisms and to predict the potential human health effects and impacts on aquatic life more accurately.

VIMS would like to address this challenge for Virginia Citizens by seeking additional funding to provide the following results:

- Cooperatively work with other Virginia state agencies, particularly the Virginia Department of Environmental Quality (DEQ), Virginia Marine Resources Commission (VMRC) and the Virginia Department of Health (VDH).
- Engagement in public education.
- Coordination of a larger-scale HAB monitoring program in Virginia waters.

- Increased and more frequent monitoring of estuarine and marine waters, particularly during the peak bloom season of summer and early fall.
- Development of appropriate response and notification protocols for future HAB events.
- Identification and quantification of species and toxins by VIMS scientists.

5. Establish a Molecular Core Lab

Rapidly advancing technology has led to a revolution in the realm of molecular biology and genomics, giving scientists much greater power to address complex problems in marine and estuarine systems. This revolution offers the opportunity for VIMS to improve its capabilities in fulfilling its advisory mission to the Commonwealth in the areas of fisheries and aquaculture, environmental health, and coastal ecology. Extremely large amounts of data can be generated in a relatively short period of time using this technology, offering unparalleled opportunities to create more sustainable environments, bolster regional economies, and protect human health.

Currently, VIMS researchers across multiple disciplines use molecular approaches to address important research questions related to resource management and public health issues in Virginia, including fisheries and aquaculture management, harmful algae blooms, and shellfish health and safety. Key pieces of heavily used shared equipment are scattered across campus and are rapidly becoming outdated. VIMS' ability to accommodate this research, which requires massively high-throughput sequencing, digital PCR, transcriptomics and single cell genomics, is limited by the absence of a centralized facility with support.

VIMS seeks funding to:

- Upgrade critical instruments.
- Add technical expertise in advanced bioinformatics.
- Add dedicated technical staff to operate and coordinate the use of specialized equipment.
- Advise researchers on appropriate strategies and approaches to answer their research questions.
- Advance VIMS compared to other top-tier marine research institutions, including Woods Hole Oceanographic Institute, Scripps Institution of Oceanography, Rosenstiel School at University of Miami, University of Rhode Island, University of Washington, and others, which already have these types of core facilities with state-of-the-art equipment and technical expertise.

- Leverage investment received to build a new science laboratory building by acquiring the needed equipment and additional staff to develop the molecular capabilities to remain competitive in the 21st Century.
- Provide the Commonwealth with state-of-the-art, science-based advice.
- Leverage the investment to increase our capabilities further and expand our capacity to receive additional extramural money in support of our research, education, and advisory missions.

6. Update and Enhance VIMS Information Systems

Critical to the operation of VIMS, is our Information Technology Networks and Security (ITNS). We have identified three priorities to ensure continuity and improvement to these operations which will ensure needed support to continue the advancements made by Virginia's premier marine research facility.

VIMS seeks funding to:

- Expand High Performance Computing (HPC) Capabilities which includes a large initial investment followed by a much smaller on-going investment
- Improve and Provide depth in local Database Management Capabilities
- Enhance VIMS' Information Technology Security Program

A4. What support can OpSix provide to help you achieve those strategies? Please include both budget and policy requests and reference Part I of your submission where appropriate.

With strategic emphasis on items 1, 2, and 3 in the first biennium as outlined above, funding is critical to achieve these goals.

While information from these efforts will directly support decision-making for local and state policy and improve our advisory service products, there is no formal request from VIMS for creation and/or implementation of policies at this time.