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DRAFT Blue Technology Business Study and Strategy

Prepared for the City of Annapolis

May 5, 2020

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Dear Dr. Nash:

BAE Urban Economics is pleased to submit this draft Blue Technology Business Study and Strategy for the City of Annapolis as an element of work on the Annapolis Comprehensive Plan Update. Please let me know if you have questions about the study, or its findings and recommendations.

Sincerely,

Mary Burkholder
Associate Principal

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Associate

Table of Contents

EXECUTIVE SUMMARY

The city of Annapolis engaged BAE Urban Economics to assess the strength and status of Blue Technology businesses in the Annapolis area. BAE researched businesses that would be considered Blue Technology that currently operate in Annapolis, case studies of other communities and regions that have implemented Blue Technology initiatives, resources available for these types of businesses, and a set of recommendations for the city to undertake to consider as it seeks to grow the industry sector.

The Blue Technology industry has emerged as a result of both the economic potential of the ocean as well as the critical need to protect the ocean. As ocean-related economic activity and innovation increases, there is a corresponding need to ensure that the innovation does not itself undermine the very resource its value is based on. Given its location and strong maritime history, Annapolis is uniquely positioned to lead the advancement of technologies that improve the sustainability and efficiency of ocean-related industries (i.e. the Blue Economy), particularly in the Mid-Atlantic region. However, while there are currently some Blue Technology businesses in and around the city, and in the region more broadly, there is no industry organization or even a full inventory of all such businesses.

Where the Blue Technology industry exists, it is organized by and discussed in terms of 'clusters of innovation,' which can be loosely understood as a cross-sector partnership of businesses, research organizations and public entities operating in a particular sector and geographical region. Three prominent Blue Technology clusters from the United States are examined: San Diego, Washington State and the South Coast of Massachusetts. All three regions are organized by these kinds of clusters, and focus industry growth by leveraging their strong history of maritime and ocean-related businesses as well as the presences of maritime institutions like the military and research universities.

As a nascent and cutting-edge industry, there are few local, state or even federal resources dedicated specifically for growing the Blue Technology industry. However, a variety of innovation- and small-business oriented loans and programs that businesses in the field can access do exist at all three levels. In general, developing a strategic plan, including establishing an entity to manage and execute such a plan, would be critical for the city to determine both the potential of Blue Technology in the region as well as the role Annapolis can play in leading that growth.

INTRODUCTION

As part of the Annapolis Comprehensive Plan update, BAE Urban Economics is providing technical assistance on the City's economic development program, including this Blue Technology Business Study and Strategy. This report includes descriptive information about some of the businesses that would be considered Blue Technology that currently operate in Annapolis, case studies of other communities and regions that have implemented Blue Technology initiatives, resources available for these types of businesses, and a summary action plan to grow this unique industry sector.

BAE undertook this project before the COVID-19 pandemic required lockdowns in March 2020. With "stay at home" orders and closure of non-essential business beginning in mid-March, it was difficult to collect specific company information. Nevertheless, this report includes information obtained from online resources as well as interviews with representatives of business associations and organizations, and some business owners that work in the sector.

This study began with an unclear definition of Blue Technology, and a portion of the study was dedicated to understanding the scope of the industry as well as establishing a nomenclature. Initially, our research was limited to Blue Technology as it is related to businesses directly or indirectly engaged in cleaning up plastic in the ocean, business engaged in offshore fish farming, and the development of autonomous boats. However, as discussed in the next section, Blue Technology is a concept broadly defined, and the Blue Technology industry and research of it is relatively nascent. Most importantly, the scope of the Maritime Industry (as it is historically referred to in Annapolis) is evolving, and Annapolis will have to expand the opportunities for new businesses by adapting to the idea of 'maritime' as it is conceived today.

WHAT IS BLUE TECHNOLOGY?

A landmark study by the OECD published in 2016 described the ocean as a "new economic frontier"[1] with immense potential for boosting economic growth. The ocean will be critical for addressing urgent issues such as food insecurity, climate change, energy production, and resource extraction while continuing to play an indispensable role in trade and global security. This study declared that the **'Blue Economy' – defined as all economic sectors which have a direct or indirect link to the ocean** – could outperform the growth of the global economy and double its economic output to $3 trillion by 2030. This OECD study has since served as the basis of Blue Economy research, plans and policies developed by Federal agencies, State agencies, other national governments, and major international institutions such as the United Nations, the World Bank, and the European Commission.

[1] "The Ocean Economy in 2030." OECD, 2016.

Despite the potential of the ocean, environmentally unsustainable practices have led to over-fishing, pollution, declining biodiversity, rising sea levels, and climate change in general, undermine the very resource the Blue Economy is seeking to leverage for growth. For the purposes of this study, **'Blue Technology' refers to research, products, and services that promote and benefit a sustainable Blue Economy**. This is distinct from major components of the Blue Economy itself (alternatively known as the Ocean Economy or Maritime Economy) such as shipping and fishing, which are unlikely to grow as industry sectors themselves in Annapolis.

There is potential, however, for Annapolis to support the advancement of technologies that improve the sustainability and efficiency of industries like ocean transportation and fishing. The opportunity that the Blue Economy represents is fundamentally based on Blue Technology and making sustainable investments. The World Bank's Blue Economy Trust Fund, PROBLUE, established in 2018, was based entirely on promoting ocean sustainability. Similarly, the "Declaration of The Sustainable Blue Economy Finance Principles" adopted by the European Commission and the European Investment Bank provides a framework for Blue Economy investments that first and foremost emphasizes protecting the ocean.

The Blue Technology industry is organized by and discussed in terms of 'clusters of innovation,' which can be loosely understood as a cross-sector partnership of businesses, research organizations and public entities operating in a particular sector and geographical region. As the discussion of case studies will show, where an emphasis on developing Blue Technology exists, organizations based on these kinds of partnerships, whether initiated by the government or business entities, are fundamental components of advancing the industry. This is due to both the highly technical nature of the industry as well as the dynamic relationship between increasing economic activity and protecting the ocean.

BLUE TECHNOLOGY IN ANNAPOLIS

Annapolis has historically been a focal point of Maryland's Blue Economy, particularly in the maritime industry (i.e., seafaring). According to a 2008 study, the city's maritime industry represents 15 percent of all maritime businesses in Maryland, and is made up of ship repair, boat building, recreational boating merchandising, boat dealing, marinas and excursion boating. In fact, in 1986, Annapolis implemented maritime zoning regulations establishing four exclusive maritime districts with distinct uses along the waterfront. These zones contain most maritime businesses in Annapolis.

Despite its legacy and strength, recent studies of the Annapolis maritime industry indicate how maritime zoning has contributed to a lack of affordable space for maritime businesses and cumbersome permitting processes and has restricted the City's flexibility to respond to the

industry's evolution[2]. Moreover, maritime manufacturing generally has shifted to low-cost employment areas overseas. The future of the industry in Annapolis will hinge upon either the expansion of the Blue Economy (beyond just maritime) in the city or in the shift of existing maritime businesses towards Blue Technology. This will involve redefining the maritime uses permitted in the city's four existing maritime zones, such as allowing more office space Blue Technology researchers and entrepreneurs.

Although there does not currently exist a list of businesses working in Blue Technology in Annapolis or even an updated list of all maritime businesses, there is a base of Blue Technology companies in the maritime industry in and around the city. These include Annapolis Hybrid Marine and Orca Green Marine. Annapolis Hybrid Marine is a reseller of inboard electric motors for recreational boats and includes an importing business for purchasing these motors from a Danish manufacturer. Orca Green Marine are pioneers in making and selling LED Navigation lights for boats, and they now license their products through Weems & Plath, an Annapolis-based supplier of nautical and navigational equipment.

Severn Marine Technologies, located outside city limits, is a developer and manufacturer of CLEARSIGNAL, a specialized bio-fouling resistant coating for undersea instruments surface platforms and undersea platforms. Additionally, Oceanetics, an engineering services company of 88 employees with 20 based just outside Annapolis city limits,[3] conducts research for clients into innovative solutions in ocean energy projects, subsea and seabed warfare, and other engineering and design services These businesses are examples of where the intersection of Blue Technology and the maritime industry exists in Maryland, and that there is potential to further investigate and develop this ecosystem.

More broadly, both the city of Annapolis and the Chesapeake Bay region have a large institutional presence for ocean and coastal area research, particularly research on the Bay. Both the Environmental Protection Agency (EPA) and the National Oceanic and Atmospheric Administration (NOAA), operate their Chesapeake Bay Offices in Annapolis, where they conduct research and manage projects to restore and protect the Bay. Other major institutions conducting research on the bay include Maryland Sea Grant College and the University of Maryland Center for Environmental Science (UMCES), although these are located in the Chesapeake Bay region and not in Annapolis itself.

The Institute of Marine and Environmental Technology (IMET), which is a campus of UMCES located in Baltimore, works to develop technologies designed to foster the protection and restoration of coastal marine systems and their watersheds, sustainable use of their resources and improvement of human health. IMET's work includes the use of aquaculture and genomics to foster conservation and creation of marine resources, including marine bioenergy;

[2] "Spurring Maritime Innovation in Annapolis." National Center for Smart Growth, University of Maryland, 2016.
[3] Oceanetics, Inc. Dun and Bradstreet Company Profile

environmental sensor development; environmental remediation; developmental biology; marine biomedicine; molecular and cellular systems and sustainable urban ports and ecosystems.[4] Notably, IMET manages 'Harbor Launch,' an incubator providing dedicated wet lab and office space, coworking space, business advising, networking, an Entrepreneur in Residence program, and other resources.

This significant concentration of research and innovation in the region suggests there is a market for Blue Technology scientific and technical products and services for new businesses located in Annapolis to meet. These could be businesses outside the maritime industry that has traditionally existed In Annapolis. These uses are also likely to be considered maritime when reviewed by the Department of Planning and Zoning and therefore able to be established in the city's four maritime zones. Accordingly, there is potentially an opportunity to expand the range of Blue Economy industries present in Annapolis. More broadly, the region may have enough Blue Economy assets and resources to develop a Blue Technology cluster.

Annapolis is uniquely positioned to cultivate regional leadership in Blue Technology as it is the State Capitol, providing a platform for advocacy and coordination with government agencies. The city, Baltimore and the Chesapeake Bay are also located just a short distance from Washington, which provides a similar opportunity at the federal level.

CASE STUDIES

San Diego, California

San Diego's Blue Economy includes over 46,000 employees, according to a 2016 study.[5] This includes over 1,400 local companies and over $14 billion in direct sales annually. The Blue Technology industry is the largest sector of the Blue Economy in San Diego, employing nearly 19,000 workers. This reflects not only the overall shift in the Blue Economy towards Blue Technology but also the presence of the U.S. Navy and the advanced research and development associated with it.

There are two parallel efforts to support the growth of Blue Technology in San Diego: The Port of San Diego Aquaculture and Blue Tech Program, and The Maritime Alliance (TMA). The Port-led Blue Economy Incubator has contributed $1.4 million in funding for eight pilot projects, provided use of port-owned property, assisted with obtaining regulatory and operational permits and other support. The range of Blue Technologies invested in is not limited to maritime specifically and includes such projects as bio-remediation and debris removal.

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[4] "About IMET." The Institute of Marine and Environmental Technology, https://imet.usmd.edu/about
[5] "Blue Economy: Sand Diego County Labor Market Analysis." The Maritime Alliance, November 2016

TMA is the preeminent industry cluster association for the Blue Technology in San Diego and represents the United States internationally in the BlueTech Cluster Association (BTCA).[6] Although TMA is not a public entity, it is committed to promoting Blue Technology in San Diego. The TMA funds periodic studies into the strength of the Blue Economy in San Diego in general and found in 2016 that the Blue Economy was the largest industry cluster in the city and the largest such industry cluster in the United States. In 2017, TMA launched the BlueTech Incubator as well as a partnership with the San Diego Unified School District to launch a BlueSTEM Career Pathway program for both students and teachers. TMA also hosts an annual BlueTech Week with events over several days, expert panelists, conference exhibitors and networking opportunities.

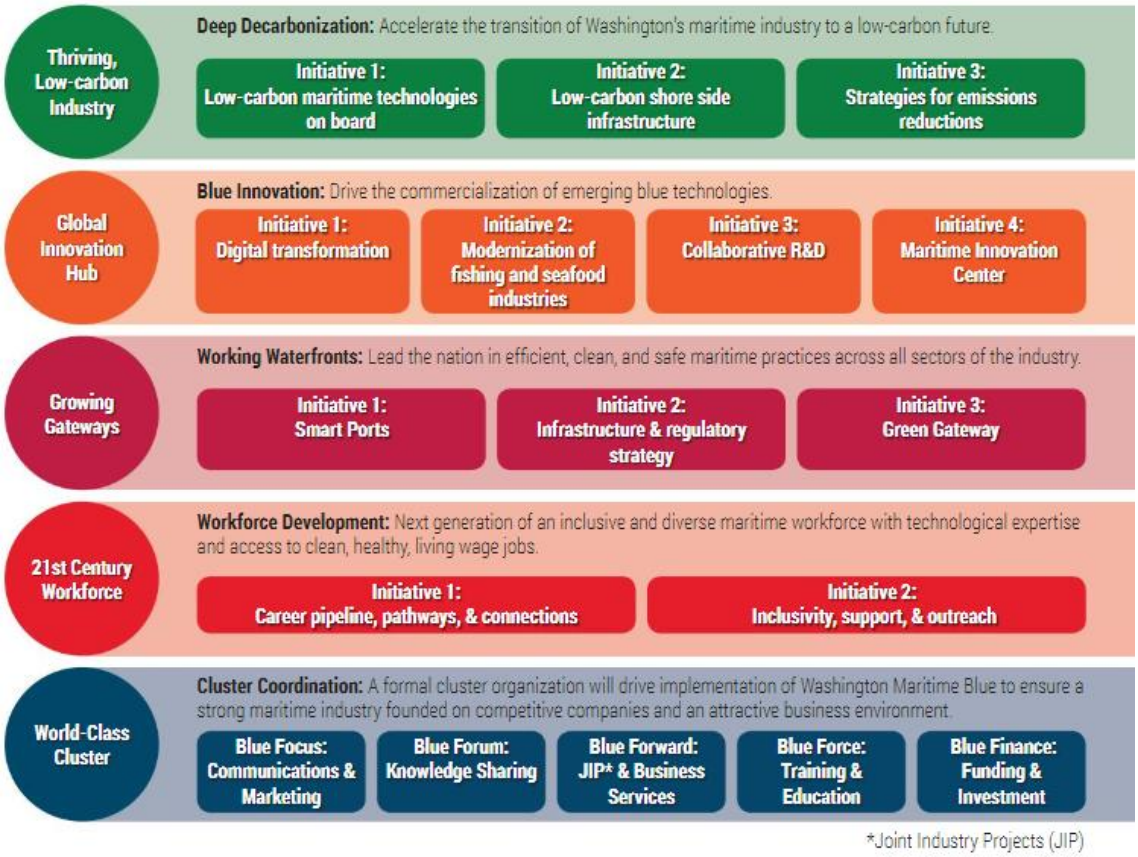
Washington State

In December 2017, Washington Governor Jay Inslee assembled the Maritime Innovation Advisory Council to develop a comprehensive plan for all stakeholders to accelerate and support technology innovation throughout the state's Blue Economy. Washington is home to several interconnected Blue Economy sectors: commercial fishing and seafood products, maritime logistics and shipping, passenger water transportation, ship and boat building, maritime support services, and ocean science technology.

The Washington State 'Strategy for the Blue Economy' was developed by stakeholders from industry, government, Tribes, research universities, and NGOs and published in January 2019. The state established a cluster organization, Washington Maritime Blue, made up of these cross-sector stakeholders to execute the plan. The plan framework consists of five strategic goals, summarized in Figure 1.

[6] "About BlueTech Cluster Alliance." BlueTech Cluster Alliance, https://www.bluetechclusters.org/

Figure 1: Washington Blue Strategy: Pathways and Initiatives



Source: "Strategy for the Blue Economy," Washington Maritime Blue

Washington Maritime Blue launched the Maritime Blue Accelerator in January 2020 as part of the strategic plan. The Accelerator is a partnership between the State, the Port of Seattle and WeWork Labs and currently manages 11 diverse start-ups, providing intensive programming over four months. Over 100 companies applied to join the Accelerator. Finally, although it was transitioned online due to COVID-19, Washington hosted its first Blue Forum in April 2020 bringing together leading investors, maritime and ocean industry professionals, entrepreneurs, and policymakers to discuss the opportunities and various finance mechanisms to accelerate innovation and sustainability in the Blue Economy.

The South Coast of Massachusetts

A large portion of the over 500 Blue Technology firms in New England are in the SouthCoast region of Massachusetts, which does not include Boston[7]. The SouthCoast Development Partnership (SCDP) promotes the economic development of the region and is focused in large part on developing the Blue Economy, including providing incubator space and resources

[7] "Marine Technology." SouthCoast Development Partnership, http://www.southcoastpartnership.org/marine-technology/

through its affiliate partner, the University of Massachusetts, Dartmouth. Funded by a $600,000 grant from the U.S. Economic Development Administration, UMass Dartmouth hosted its second annual Marine Science and Technology Symposium in October 2019. The city of Boston, Massachusetts does not have a publicly coordinated Blue Technology sector, although it is home to several Blue Technology firms as well as a leading Blue Technology incubator, SeaAhead, which partners with the Cambridge Innovation Center to provide working space and business resources.

Like Annapolis, the South Coast of Massachusetts is itself historically a maritime area within a larger maritime region. The region also benefits from its proximity to major institutions like Rhode Island's Naval Undersea Warfare Center, Woods Hole Oceanographic Institute in Falmouth, MA, and the University of Rhode Island's Ocean Engineering Center. In fact, the SCDP is currently developing a strategic plan to enhance the Blue Technology sector in partnership with the broader Southeast Massachusetts region and Cape Cod as part of developing a Blue Technology corridor on Interstate-95. Following the completion of the strategic plan--expected in 2020--the SCDP will move to funding Blue Technology research, investing in workforce training and finding export markets for existing products.

PROGRAMS, TOOLS, AND RESOURCES

Federal

Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR)

Through a competitive awards-based program, the Small Business Innovation Research (SBIR) program enables small businesses to explore their technological potential and provides the incentive to profit from its commercialization. Each year, federal agencies with extramural research and development (R&D) budgets that exceed $100 million are required to allocate 3.2 percent (FY 2017) of their R&D budget to these programs. This includes NOAA, the Department of Defense, the Department of Energy, and other agencies that are related to the Blue Economy.

The SBIR program is structured in three phases. Phase 1 awards do not exceed $150,000 (for six months) and Phase 2 funding does not exceed $1,000,000 (for two years). Phases 1 and 2 are intended to establish scientific and technical merit, while Phase 3 is awarded to pursue commercialization of work from Phases 1 and 2.

Similar to the SBIR, the Small Business Technology Transfer (STTR) program requires small business to formally collaborate with a research institution in Phase 1 and 2. Given the institutional research presence in Annapolis and the region, this may be a viable path to funding for Blue Technology small businesses.

State

Maryland Industrial Partnerships (MIPS)

The Maryland Industrial Partnerships (MIPS) program promotes the development and commercialization of products and processes through industry/university research partnerships. MIPS provides matching funds to help Maryland companies pay for the university research. Projects are initiated by the companies to meet their own research and development goals. The maximum MIPS award for any single project is $100,000 per year for large and small companies and $90,000 for start-up firms. Projects may also help a company plan and develop industrial training programs for its employees.

Research and Development Tax Credit

Businesses that have qualified research expenses (QREs) in Maryland may qualify for two state income tax credits, the Basic R&D Tax Credit (up to three percent of eligible expenses) and the Growth R&D Tax Credit (up to 10 percent of eligible expenses).

Maryland Technology Development Corporation (TEDCO)

TEDCO's mission is to enhance economic development by fostering and developing innovation. Key activities include the Maryland Technology Commercialization Fund (TCF), the Life Science Investment Fund and Gap Investment Fund for small businesses. TEDCO also manages an Incubator Development Fund that supports incubators across the State, although there are none in Annapolis. This may be a pathway to starting a Blue Technology incubator.

Local

VOLT Fund

Anne Arundel Economic Development Corporation manages the VOLT Fund on behalf of the Maryland Department of Commerce. Small and minority, women and veteran owned businesses in Maryland may be eligible for a loan through the VOLT Fund. Loans are between $25,000 and $500,000 and can be used for a range of purposes including business and commercial real estate acquisition and expansion, lease-hold improvements, equipment, and working capital.

RECOMMENDATIONS

Local and regional assets position Annapolis to take advantage of the emerging and growing Blue Technology sector and could allow the City to establish itself as an innovation hub for the region. Below are recommended, actionable steps the city can take to establishing a Blue Technology hub in Annapolis for the region. Note that short-term is considered within 18 months, medium-term is 18 months to three years, and long-term is beyond three years.

1. **Catalogue maritime and Blue Technology businesses in Annapolis**
   Party: Annapolis Office of Economic Development
   Timing: Short-term

   The most recent comprehensive inventory and analysis of maritime businesses in Annapolis is the Maritime Industry Economic Survey from 2008. This report provided an overview of the U.S Maritime Industry, Annapolis maritime businesses, Annapolis maritime demand, and a survey of all maritime businesses in the city. Maritime businesses were classified by type, and data on employment levels, payroll, and the overall economic impact of the maritime industry in Annapolis is also provided. While an analysis this thorough would be useful to reproduce ahead of developing comprehensive Blue Technology, a shorter version that identifies and classifies maritime businesses would be a useful starting point.

2. **Assess regional Blue Technology ecosystem**
   Party: Annapolis Office of Economic Development, Anne Arundel County Economic Development Corporation, Maryland Department of Commerce
   Timing: Short-Term

   In partnership with counties in the Chesapeake Bay region and the Maryland Department of Commerce, the city should identify regional Blue Technology clusters, incubators, and researchers, from around Baltimore and the Chesapeake Bay. This can be used to generate a list of contacts and serve as the basis for understanding the kinds of Blue Technology activity occurring in proximity to Annapolis.

3. **Host a Blue Technology Forum in Annapolis**
   Party: Annapolis Office of Economic Development, Anne Arundel County Economic Development Corporation, Maryland Department of Commerce; Private Sector partners; University of Maryland and other research institutions.
   Timing: Short- to Medium-Term

   Given the city's central location and institutional presence, Annapolis can host a forum that explores the scope of the Blue Technology industry in the region and State. The

agenda should focus on trends in the sector, financing options available for start-ups and researchers, and case studies of successful Blue Technology economic development strategies from around the country. The city could arrange for speakers from other Blue Technology clusters as well as from local institutions such as the University of Maryland. Coordinating the organization of Blue Technology stakeholders will allow Annapolis to develop a leadership role for developing the industry sector in the region.

4. **Develop a strategic plan for Blue Technology for the region**
   Party: Annapolis Office of Economic Development; New cluster organization for the region, potentially based in Annapolis
   Timing: Medium-Term

   This will begin by identifying funding for the study, such as the Sea Grant. The strategic plan should include projects, policies, initiatives and goals with milestones and measurable outcomes to help nurture the Blue Economy ecosystem. A lead organization will need to be formed, in order to both develop and execute a strategic plan. This could be the cluster organization itself representing Blue Technology in the region but headquartered in Annapolis.

5. **Establish a special workforce development program**
   Party: Annapolis Office of Economic Development, Anne Arundel County Economic Development Corporation, Anne Arundel Community College
   Timing: Long-Term

   A workforce program for Blue Technology could be established with two goals: helping to transition current maritime workers towards Blue Technology and recruiting and training new workers in the field. This program does not necessarily need to be independent of existing workforce programs, such as those offered through the Anne Arundel Workforce Development Corporation. Anne Arundel Community College also hosts a workforce training program and has the Entrepreneurial Studies Institute with a small business incubator, the Hatchery, that could be utilized for Blue Technology businesses as well.

6. **Enhance education programs and partnerships with schools and colleges**
   Party: Anne Arundel County Public Schools, Anne Arundel Community College
   Timing: Long-term

   Leverage existing STEM programs at local high schools and colleges to develop Blue Technology-specific courses, projects, and internships for interested students. This would help to create workforce pipeline for the industry, particularly in the long run.