

### Port Supports Innovative Debris Removal System through Innovation Partnership

A new approach to support new technologies to help solve issues facing ports around the world puts the Port of San Diego at the forefront of innovation. Through its newly established Blue Economy Incubator, The Port, in partnership with Zephyr Marine Debris Removal, is demonstrating an innovative new marine vessel and technology to better understand and address marine debris in San Diego Bay.

#### Marine Debris Pollution

Ports worldwide are at the forefront of the challenges associated with marine pollution. Marine debris, especially plastics, can adversely impact aquatic wildlife through ingestion and/or entanglement, negatively affect human health, degrade environmental quality, and reduce the aesthetics of coastal environments.

#### Innovation Partnership

Traditionally, Ports are funding innovative projects through service agreements or grants. However, in 2016, the Port established a Blue Economy incubator to attract and support innovative pilot project proposals and help solve port-related issues.



The one-year pilot project is demonstrating the cost-effectiveness of a new way of addressing marine debris removal and developing a database of key variables influencing marine debris accumulation in San Diego Bay.

**Benefits to Environmental Quality:** By demonstrating an innovative and cost-effective way of removing marine debris, and building a database to better understand and address marine debris accumulation, the project is contributing to make the San Diego Bay cleaner and safer for humans and wildlife.

**Level of Independent Involvement:** The Port contributed \$100,000 in funding to the pilot project, provided use of Port-owned property for vessel docking and debris unloading, and Port staff dedicated over 50 staff hours to launch the project.

**The Creativity of the Program:** The Port has supported this pilot project through an innovative incubator partnership.

**Program Results are Apparent:** Since the project started in February 2018, over 5,000 pounds of debris have already been removed from the San Diego Bay.

**Cost Effectiveness:** By supporting the project through its Blue Economy incubator, the Port is supporting innovation and at the same time creating opportunity to earn revenue that can be reinvested into future innovation.

**Transferability of the Program:** This project is an example of innovation and innovative partnership approach which can be replicated throughout the port industry.

**Jason Giffen**

Assistant Vice President  
Planning and Green Port

3165 Pacific Highway, San Diego, CA 92101  
619-686-6473



**2018 American Association of Port Authorities  
Environmental Awards  
Environmental Mitigation**

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**Jason Giffen**  
Assistant Vice President  
Planning and Green Port  
3165 Pacific Highway, San Diego, CA 92101  
619-686-6473

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## Port Supports Innovative Debris Removal System through Innovation Partnership

### I. Introduction

Marine debris, especially plastics, can adversely impact aquatic wildlife through ingestion and/or entanglement, negatively affect human health, degrade environmental quality, and reduce the aesthetics of coastal environments. Ports worldwide are at the forefront of the challenges associated with marine pollution. The Port of San Diego, in partnership with Zephyr Marine Debris Removal, is demonstrating an innovative new technology to better understand and address marine debris in San Diego Bay using a custom-made vessel and patent-pending skimming technology to remove marine debris in the San Diego Bay. And by funding this project through the Port's Blue Economy Incubator, the Port is using an innovative approach to fund innovation, as well as tomorrow's next innovative idea.

In 2018, the Port entered into an agreement with Zephyr Debris Removal (Zephyr) for a one-year pilot project to demonstrate a custom-made vessel and skimming technology to remove marine debris in the San Diego Bay. Since the start of the pilot project operations in February 2018 over 5,000 pounds of marine debris has been removed from the San Diego Bay. Concurrently a database is being developed for key variables influencing marine debris accumulation in San Diego Bay - such as location, seasons, weather events, tidal swings, and type of debris. This pilot project will help ascertain hot spot areas and trash accumulation patterns in San Diego Bay and ultimately inform ongoing efforts by the Port to prevent and reduce marine debris accumulation and improve water quality.

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Traditionally, the Port may have funded such a project through a service agreement or a grant. However, in 2016, the Port established a Blue Economy incubator to attract and support innovative solutions to port-related issues. As a property-owner and regulator of land and water in San Diego Bay, the Port is uniquely positioned to remove barriers to entrepreneurs by providing key assets and services such as permit-ready infrastructure, entitlements assistance, marine spatial planning tools, market access, and strategic funding. With Zephyr, the Port provided funding of \$100,000, use of Port-property for vessel docking and debris unloading, assistance with permits and other support, in exchange for a long-term royalty from Zephyr's operations and technology. If the Zephyr technology is adopted in ports and bays elsewhere, the Port will share in Zephyr's success and the Port's share of revenue can be reinvested into new innovation projects or used to fund the Port's other operations like parks, police, and other public services.

This new approach to partner with a company to support new technologies to help solve issues facing ports around the world puts the Port of San Diego at the forefront of innovation. The Port's Blue Economy incubator has already become a successful launching pad for innovative pilot projects; to date the Port has launched five pilot projects ranging from shellfish nursery operations, to copper remediation technology, a Drive-in Boatwash, a smart marina app, and the marine debris removal vessel.

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### II. Goals and Objectives

Port project goals:

- To demonstrate the effectiveness and potential scalability of a custom-made vessel and patent-pending skimming technology and debris removal service model.
- To develop a database for key variables influencing marine debris accumulation in San Diego Bay - such as seasons, weather events and tidal swings - for the determination of hot spot areas and trash accumulation patterns.
- To inform existing Port programs aimed at preventing and reducing debris accumulation in San Diego Bay.
- To generate revenue for the Port that can be reinvested into new innovation projects or used to fund the Port's other operations like parks, police, and other public services.

### III. Discussion

#### A. Background

The Port of San Diego, in partnership with Zephyr Marine Debris Removal, is conducting a project to demonstrate a custom-made vessel and patent-pending skimming technology to remove marine debris in the San Diego Bay. The project, supported through the Port's Blue Economy Incubator, is demonstrating the cost-effectiveness of a new way of addressing marine debris removal and developing a database of key variables influencing marine debris accumulation in San Diego Bay.

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The pilot project was initiated in February 2018, and already, 5,000 pounds of debris has been removed from San Diego Bay, including: various food packaging, polystyrene foam, straws, fishing lines, single-use plastic bags, plastic bottles, and a multitude of other debris.

In 2016, the Port of San Diego established a Blue Economy incubator to attract and support innovative solutions to port-related issues. Through the Incubator, the Port removes barriers to entrepreneurs by providing key assets and services such as permit-ready infrastructure, entitlements assistance, marine spatial planning tools, market access, and strategic funding, in exchange for a share of future revenue from the supported company or technology. The Port's share of revenue can be reinvested into new innovation projects or used to fund the Port's other operations like parks, security, and other public services. This new way to partner with a company to support new technologies to help solve issues facing ports around the world puts the Port of San Diego at the forefront of innovation.

### **B. Methodology**

For the duration of the one-year pilot project, Zephyr will conduct trash skimming operations 6 hours per day, 4 days per week. The custom-made vessel features unique patent-pending skimming technology designed to solve a variety of logistical hurdles for efficient marine debris removal including removal of small debris, and access to shallow and rough water. As part of the pilot project operations, Zephyr is also developing and maintaining a database for key variables influencing marine debris accumulation in San

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Diego Bay - such as seasons, weather events and tidal swings - for the determination of hot spot areas and trash accumulation patterns.

The skimming operations consist of driving the vessel and using the custom-made “marine debris hoop net” to collect marine debris within a pre-determined area of San Diego Bay - between the Coronado Bridge to the South and the Coast Guard base to the North.



**Figure 1.** Skimming operations using custom-made hoop net.

To allow for post-collection categorization of the debris collected, a picture is taken for each skimming area for future data analysis (see figure 2 below.). A hand crank davit system is used to transfer the marine debris collected into trash bins onboard the vessel, and then a photo sample is recorded for each bin.





**Figure 2.** Debris collection system and sample photograph.

The debris removal operations were initiated in February 2018. Already over 5,000 pounds of debris has been removed, including: various food packaging, polystyrene foam, straws, fishing lines, single-use plastic bags, plastic bottles, and a multitude of other debris. After removal from the San Diego Bay, this marine debris is being disposed of in a landfill in accordance with all federal, state and local laws, rules, and regulations. Zephyr is providing quarterly progress reports detailing the effectiveness of the operations, types and amount of debris collected, weather, tides and current, and locations of debris removed. A final report will provide an assessment of overall pilot project performance such as trash management and monitoring recommendations, marine debris hotspots with correlation on key variables, and scalability of the project.

### **C. How The Project Meets Award Criteria:**

#### ***1. The level and nature of benefits to environmental quality, beautification or community involvement:***

By demonstrating an innovative and cost-effective way of removing marine debris, the project is making the San Diego Bay cleaner, safer for human and wildlife, and overall

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more beautiful. The project also helps to increase community awareness and support of the Ports to prevent and clean-up marine debris. Further, due to the innovation incubator, the project may lead to future revenue for the Port that can be reinvested into further innovation or Port-services.

### ***2. The level of independent involvement and effort by the Port:***

Through its Blue Economy Incubator, the Port contributed funding to the pilot project in the amount of \$100,000, provided use of Port-owned property for vessel docking and debris unloading, and Port staff dedicated over 50 staff hours to the project in assistance in obtaining all regulatory permits, and assistance with community and media relations.

### ***3. The creativity of the solution or programs:***

As described above, the project is demonstrating the effectiveness of a custom-made vessel featuring unique patent-pending skimming technology designed to solve a variety of logistical hurdles for efficient marine debris removal. It is also developing and a database for key variables influencing marine debris accumulation in San Diego Bay - such as seasons, weather events and tidal swings - for the determination of hot spot areas and trash accumulation pattern to better deploy resources in the future.

The Port has supported this innovative project through an innovating incubator partnership. The port has provided funding, property use, and other support in exchange for future royalties from services and technology being demonstrated. This Port revenue can be reinvested into new innovation projects or used to fund the Port's

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other operations like parks, security, and other public services. This new way to partner with a company to support new technologies to help solve issues facing ports around the world puts the Port of San Diego at the forefront of innovation.

### **4. *Whether the project or program results are apparent:***

The pilot project has already removed significant marine debris from the San Diego Bay, and the community has told the Port that “*the Bay never looked so clean!*” Since the start in February 2018, over 5,000 pounds of debris have already been removed from the San Diego Bay, including: various food packaging, polystyrene foam, straws, fishing lines, single-use plastic bags, plastic bottles, and a multitude of other debris. Further, the collected information on the types and amount of debris collected, weather, tides and current, and locations of debris removed will inform future efficient deployment of resources to best keep the San Diego Bay clean.

### **5. *The cost effectiveness of the activity or the program:***

The project is demonstrating how the custom-made vessel featuring a unique patent-pending skimming technology, can more effectively remove marine debris. The vessel can more effectively target marine debris, enter locations with shallow water or rough conditions, and capture smaller debris that traditionally collected by hand and net. Further, by supporting the project through its Blue Economy incubator, and receiving future royalties from the demonstrated services and technology, the Port is supporting innovation at the same time as creating opportunity to earn revenue that can be reinvested into new innovation projects or used to fund the Port’s other operations like

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parks, police, and other public services – including future marine debris removal and prevention efforts.

### **6. *The transferability of the technology or idea to the port industry:***

This project is an example of innovation technology and an innovative partnership with the Port which can be replicated through the port industry. All ports face a growing marine debris problem. The project will demonstrate the cost-effectiveness of the new technology and gather important data. In the future, other ports may rely on this technology to address their needs. Through the innovative Blue Economy Incubator partnership, the Port of San Diego will financially benefit from the success of the technology. Other ports may consider supporting innovation in similar ways and generate revenue to reinvest in new ideas or pay for other port services.

## **IV. Conclusion**

Marine debris, especially plastics, can adversely impact aquatic wildlife through ingestion and/or entanglement, negatively affect human health, degrade environmental quality, and reduce the aesthetics of coastal environments. The Port of San Diego, in partnership with Zephyr Marine Debris Removal, is demonstrating a innovative new technology to better understand and address marine debris in San Diego Bay using a custom-made vessel and patent-pending skimming technology to remove marine debris in the San Diego Bay. By funding this project through the Port's Blue Economy Incubator, Port is using an innovative way to fund innovation, as well as tomorrow's next innovative idea. This new way to partner with a company to support new technologies

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