

Flotsam & Jetsam: Leading Environmental Restoration in Cleveland Harbor

2013 AAPA Environmental Awards Competition

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2013 will be the first full year of service for Flotsam and Jetsam – the sister work boats envisioned, designed and commissioned by the Port of Cleveland to capture and remove the large amount of floating debris that enters Cleveland Harbor each year.

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1 Introduction: Flotsam & Jetsam

Floating debris in Cleveland Harbor is an ongoing aesthetic nuisance and a U.S. Environmental Protection Agency (U.S. EPA) designated environmental stressor. It is also an eyesore and a potential hazard not just in the river but in North Coast Harbor, and further along Cleveland’s Lake Erie shoreline.

To address this issue, the Port of Cleveland, along with assistance from the U.S. EPA, developed a design concept for a specialized vessel system to remove floating debris from the harbor. In 2012, the designs were transformed from sketches to reality when the two vessels – Flotsam and Jetsam – were built and commissioned for service in Cleveland in the late summer of 2012. The two vessels and their specialized equipment comprise the “Debris Harvester System”.

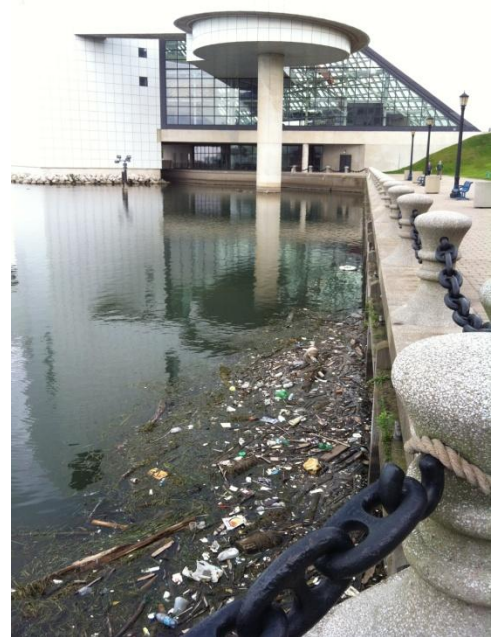
Sea trials, crewing, and training took place in September 2012 and Flotsam and Jetsam received a true proof-of-concept as an integral part in the October 2012 Hurricane / Super Storm Sandy clean-up efforts.

2013 is the first full season of operation for Flotsam and Jetsam and the Port, along with its waterside beneficiaries, is excited about the environmental and aesthetic impact the vessels provide.

The Port of Cleveland is proud of the environmental enhancements it has made for the community and is entering Flotsam & Jetsam into the 2013 AAPA Environmental Awards Competition for the “Environmental Enhancement” category.

1.1 Challenge

Floating debris in Cleveland Harbor (the Federal Navigation Channel and Lakefront) is listed by the U.S. EPA and the Cuyahoga River Remedial Action Plan (RAP) as an environmental stressor. The debris varies widely in size, being comprised of trees, branches, logs, tires, and street trash, including bottles, food containers, and construction materials. Debris is often introduced to the waterways via the combined sewer overflow (CSO) system and thus, can be dangerous to handle and may present hazards to people, recreational boaters, birds, fish and other wildlife.



Depending on weather cycles, between 400 and 800 cubic yards of debris (100 to 200 tons) enter the waterway each year. As a result of wind and unique channel shape, floating debris tends to accumulate in large mats in several known locations. This is a documented environmental impairment



on the Cuyahoga River and the RAP identifies the removal of debris as an appropriate remedial action for eliminating this impairment.

While several floating debris removal products exist in the market place, none

proved capable of dealing with the tight maneuvering conditions and wide variety of floating material found in the Cuyahoga River. A sensible, cost-effective, and implementable solution that could support the unique waterway needs was required.

1.2 Solution

The conceptual elements of a “Debris Harvester System” was developed based on prior research by several parties, most notably Northeast Ohio Regional Sewer District’s Floatables Study (2000) and the



Cuyahoga River Remedial Action Plan Delisting Action Report (2009). In addition to formal studies, hands-on experience with prototype marketplace products was considered. The debris removal system developed by the Port of Cleveland includes an innovative and unique combination of industrial and

maritime features, to include:

- **Two custom designed marine grade aluminum sister vessel work barges – Flotsam and Jetsam** – each is 25 feet 10 inches long by 11 feet wide, with 160 hp in-board diesel engines. Each vessel has manageable ballast and displaces up to 18,000 lbs of water.

- **Flotsam carries a Bobcat® mini-excavator fitted with a custom shovel with a turreted excavator to scoop out debris and load it on the adjacent sister vessel. The turret operation minimizes the need for vessel maneuvering during debris removal, thus keeping the debris in position for efficient**



pickup. The excavator uses a custom designed high capacity, self draining debris scoop. The aluminum shovel maximizes lifting capacity for debris. Each shovel scoop lifts about a one-half of a cubic yard of floating debris, which is then loaded on to Jetsam.

- **Jetsam carries a pair of Waste Management, Inc. Bagsters® trash containers for holding and transporting debris. Bagsters®, which are 4 feet wide by 8 feet long by 30 inches high fabric trash receptacles, were developed for small construction sites and residential clean-up. Waste Management, the developers of Bagsters® has acknowledged that floating debris is a unique**

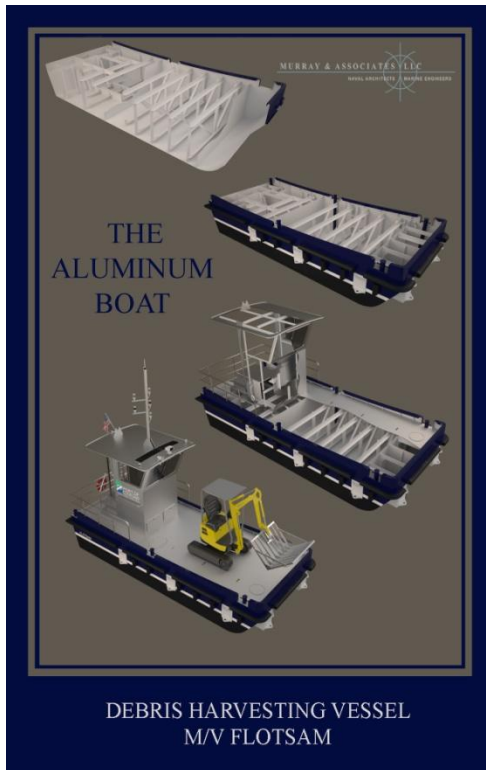


application. Bagsters® save significant weight and provide an efficient mechanism for debris disposal. Each Bagster® can hold 3 cubic yards of debris. **Jetsam also carries an 18 hp (4,000 lb capacity) hydraulic crane with an articulated grapple.** The crane is used to lift the loaded Bagsters® on to shore for disposal, and also to

pick up tires, small logs and other large items from the water.

- **Floating booms** developed by Elastec/American Marine, for containing chemical spills. In our application the booms are prepositioned in known areas where debris mats accumulate and are used to efficiently contain and corral the material for controlled removal by Flotsam and Jetsam. The two vessels are also designed to tow a 250 foot floating boom between them in a trawling action to sweep loose debris from the channel. The vessels' power plant and propeller specifications were designed for efficient towing.
- **Each vessel also carries a 1,000 gallon per minute water pump** which is used to push floating debris into dense mats for efficient removal. The pumps have also been useful for cleaning debris from landside docks.
- **The vessels are outfitted with a pinning system that allows them to be joined together** by high strength steel pins. The pins and brackets allow configuration of the vessels in a variety of operation formats to ease rapid excavation and loading of debris. When pinned together, heavy loads can be safely lifted on shore, without excess listing. The pins are durable and simple to use.

The Port's Debris Harvester System provides a unique solution for a combination of challenges posed by floating debris. The vessels are durable, powerful and compact and able to work efficiently in tight quarters. With multiple tools and equipment available, the vessels are able to address a variety of floating debris items, which is a unique capability. They have demonstrated their ability to tow, lift, sweep, corral and remove all types of floating debris. Almost all of the debris removal can be safely accomplished without direct handling by the crew.



Performance and operating parameters were identified and developed by the Port and were provided to the naval architecture firm, Murray and Associates of Fort Lauderdale, Florida. Murray and Associates developed plans, specifications, scantlings, layout, buoyancy evaluations, and bid and construction documents.

The vessels were built by Lake Assault Boats of Superior, Wisconsin and launched in September 2012 (Flotsam) and October 2012 (Jetsam).

Following launch and dock-side inspections, the vessels were put through a specified sea trial process, where all systems and features were tested and calibrated. The vessels' performance exceeded all aspects of the design parameters.

During the construction period the Port engaged Downtown Cleveland Alliance, to recruit and select potential crew for the vessels. The Port also developed a training program to assure the crew was well versed in all necessary aspects of safe vessel operations and mission.

The vessels were officially commissioned for service on October 17, 2012.



1.3 Results

The vessels and crew have performed beyond expectations. They were put to the test just a couple short weeks after their commissioning, when 70 mile per hour winds from Superstorm Sandy battered the Cleveland lakefront. Flotsam and Jetsam weathered the storm without damage, but the Storm did extensive damage to the lake shore, most notably to local marinas where many boats were sunk.

Flotsam & Jetsam and the crew immediately jumped to assist with the clean-up of debris and recovery of vessels. They worked closely with the Ohio Department of Natural Resources (“ODNR”) and

removed approximately 24 tons of floating debris – primarily from sunken vessels – generated from the storm.



This important and unplanned mission provided the proof of the applicability and success of the Debris Harvester System in achieving its mission.

2 Goals and Objectives

The Port's objectives for introducing the Debris Harvester System are threefold:

1. To restore and protect the environmental quality of the Cleveland lakefront and Cuyahoga River ship channel.
2. To improve the aesthetic condition of Cleveland’s waterways by removing unsightly floating debris.
3. To improve safety for water users (i.e. recreational boaters, swimmers, etc.) by removing floating debris.

2.1 Restore and Protect Environmental Quality

Removing and controlling floating debris on the waterway is a U.S. EPA delisting action that helps with the process of removing the Cuyahoga River from the Area of Concern. The 50th anniversary of the fire on the Cuyahoga River is approaching and the introduction of Flotsam and Jetsam is a major step that gets us closer to this goal.



2.2 Improve Aesthetic Conditions

The removal of floating debris directly impacts the aesthetics of the waterways and beaches. The debris is largely made-up of urban litter that is introduced to the waterways via storm sewers. The accompanying pictures provide an illustration of the aesthetic impacts being addressed.

2.3 Improve Safety for Water Users

Floating debris can be a challenge to recreational and industrial maritime users alike. Plastics, for example, can get caught on motors or clog an intake valves causing power loss. Floating logs – often

more than 10 feet long – pose a serious challenge as much of the log is often submerged and not visually noticed until an impact.

3 Fulfilling the AAPA Environmental Enhancement Award Criteria

3.1 Background

Each year, more than 100 tons of debris is introduced into Cleveland Harbor. The debris – primarily organic yard waste (e.g. trees and branches) and street litter – wash into the waterways following heavy rain events. The Port of Cleveland, with the help of a U.S. EPA grant, recently designed, built, crewed, and launched two boats specifically designed to capture and remove floating debris from Cleveland’s Harbor. The boats are named Flotsam and Jetsam and together they make up the Debris Harvester Vessel System.

3.2 Objectives and Methodology

The Port’s objectives for introducing the Debris Harvester System are threefold:

1. To restore and protect the environmental quality of the Cleveland lakefront and Cuyahoga River ship channel.
2. To improve the aesthetic condition of Cleveland’s waterways by removing unsightly floating debris.
3. To improve safety for water users (i.e. recreational boaters, swimmers, etc.) by removing floating debris.

Knowing that Cleveland’s lake and river network needed vessels that were durable, powerful and compact to be able to work in tight quarters, the Port set-out to (a) understand the type of missions that

would be required – to include the types of debris and geographic challenges, (b) evaluate market-available alternatives, and (c) perform a gap analysis of buy versus design / build alternatives.

Not finding any suitable market-available options, the Port began developing specifications for what would be required to safely and efficiently capture and remove floating debris from Cleveland’s waterways. Following a national solicitation process, the Port enlisted a naval architect to develop official specifications and documents for manufacture. The vessels were built and delivered to Cleveland for calibration and sea trials. They were formally launched into service in mid-October 2012.

3.3 How the Project Fulfills the Award Criteria

3.3.1 Level and nature of benefits to environmental quality

The Port’s introduction of Flotsam and Jetsam in Cleveland has had positive impacts on local environmental quality, beautification efforts, and community involvement initiatives.

3.3.1.1 Environmental quality

Removing and controlling floating debris on the waterway is a U.S. EPA delisting action that helps with the process of removing the Cuyahoga River from the Area of Concern. The 50th anniversary of the fire on the Cuyahoga River is approaching and Flotsam and Jetsam get us closer to this goal.

3.3.1.2 Beautification

The removal of floating debris directly impacts the aesthetics of the waterways and beaches. The debris is largely made-up of urban litter that is introduced to the waterways via storm sewers. The accompanying pictures provide an illustration of the aesthetic impacts being addressed.

3.3.1.3 Community involvement

Flotsam and Jetsam have become local heroes. The boats are very visible to people visiting the shoreline and from office buildings. They have become a sense of pride for Clevelanders and are often the subject of local social media conversation.

3.3.2 Level of involvement by the Port Authority

The Port of Cleveland owns and commands vessel operations. The Port contracts with the Downtown Cleveland Alliance (“DCA”) to crew the vessels. Another key partner is the Cuyahoga River Remedial Action Plan (“RAP”), a community planning organization. The Port worked with the RAP to understand the needs of the local waterways and to assist with the application for funding support.

Most notably, the U.S. Environmental Protection Agency is to thank for primary funding via a Great Lakes Restoration Initiative grant for \$425,160.

3.3.3 Creativity of the solution

The Port’s solution was developed based on years of experience and consideration for the local waterways. Cuyahoga literally means “crooked river” and the nature of the waterway, with its varied nooks and crannies, calls for unique approaches when navigating. The creativity of the Flotsam and Jetsam design is one that is proving to be of great benefit to the region.

3.3.4 Project results and success

In just two weeks following their launch in 2012, Flotsam and Jetsam were put to the ultimate test. On October 29th and 30th, 2012, Cleveland was subjected to Superstorm Sandy. The storm did



extensive damage to the lakeshore, and most notably to Edgewater Marina, where more than 30 boats were sunk. Flotsam and Jetsam not only weathered the storm without damage, but worked with the Ohio Department of Natural Resources to remove approximately 24 tons of debris from the storm – including several sunken boats.

In just a few weeks of service in 2013, the pair has already removed approximately 25 tons of debris from the waterway, as well as more than two dozen 12 foot plus sized logs. The boats have a full calendar this summer and early fall of removing debris and ensuring a clean and safe waterway throughout the City.

3.3.5 Cost effectiveness

The boats were designed, manufactured and launched for approximately \$425,000 (thanks to a grant from the U.S. EPA). Annual operating costs – to include staffing, dockage, fuel, equipment, etc. – is estimated to be approximately \$80,000 per year. This is being funded by the Port and is a small price to pay for the priceless payoff.

3.3.6 Transferability to the port industry

The Port of Cleveland's debris harvesting system offers a unique combination of capabilities not available on the market today. The power, maneuverability, and versatility of Flotsam and Jetsam and their array of tools is a model for other harbors – specifically those with difficult to navigate waterways with varied waterfront land uses and bulkhead conditions. Waterfront areas throughout the Great Lakes, as well as older cities with similar sewer networks, are prime candidates to consider a similar system.

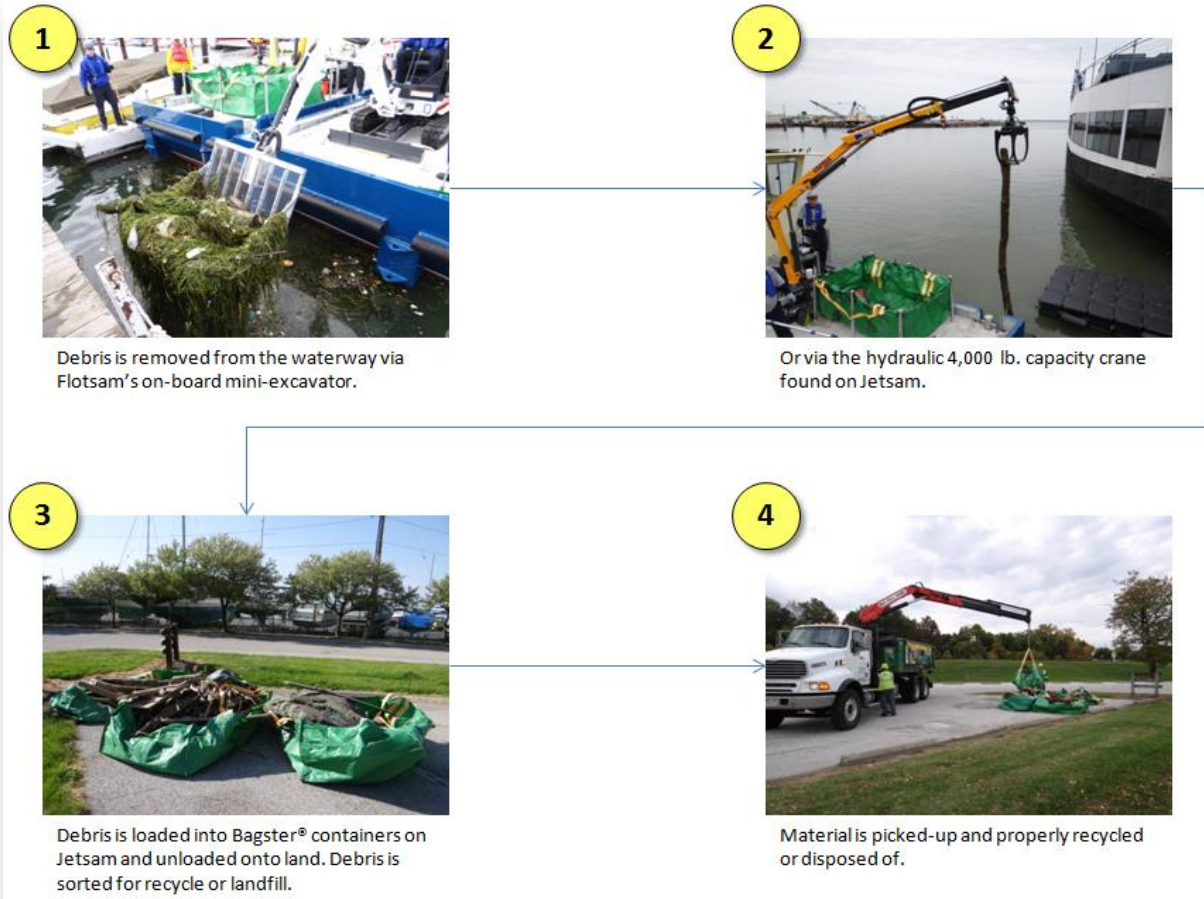
4 Conclusion

In 2011, the Port of Cleveland undertook a comprehensive Strategic Action Plan that included *Leading Critical Initiatives for Cuyahoga River Renewal*. The Port's introduction of Flotsam and Jetsam is meeting its goals and objectives to (a) restore and protect the environmental quality of the Cleveland waterways, (b) improve the aesthetic condition of the waterways, and (c) improving overall safety for industry and recreational users of the waterways. Flotsam and Jetsam, along with other environmental and infrastructure initiatives being led by the Port Authority has been a great asset to the City of Cleveland and the region as a whole. As a result, public interest in the Port and its ability to make actionable change continues to increase. .



Appendices

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Representative Media Reports

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The Plain Dealer. *Port Authority's debris-catching boats take to Lake Erie in time for Hurricane Sandy* http://www.cleveland.com/metro/index.ssf/2012/12/port_authoritys_debris-catchin.html

Cleveland Rowing Foundation. *New Port work boats will soon begin removing floating debris from Cleveland Harbor* <http://www.clevelandrows.org/content/flotsam-and-jetsom-port-authority>

MarineLink. *Cleveland to Commission Two Cleanup Workboats* <http://www.marinelink.com/news/commission-cleveland348510.aspx>

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