

**White Paper submitted 4 Sept 2020 by RESTCo in Response to the  
BSEE Broad Agency Announcement (BAA)140E0120R0006 for Proposed  
Research on Improved Oil Recovery in Thin Oil Slicks and Oil Sheens**

**RESTCo's White Paper is responding to Topic 2 of the above BSEE BAA - Development of Materials and/or Technologies to Improve Oil Sheen Recovery**

**Background Information**

We can see from the photo below of the recent oil spill in Mauritius that the booms are leaking oil and that the oil spill is being carried in narrow streams by strong localized currents (see Ref. 1). The same pattern occurred in 2007, as shown in satellite images (see Ref. 2), when the container ship MV Cosco Busan struck Delta Tower of the San Francisco-Oakland Bay Bridge in thick fog.

Floating booms are not the best solution in strong currents, especially tidal currents that change direction 4 times a day. We propose a swarm of 23 ft skimmers, operating without booms, where booms can't contain the oil spill adequately, that can arrive within hours by road on trailers, rather than the present 50 ft skimmers that normally take days to arrive. Quick response is critical.

Our skimmers can follow the fast-moving oil streams and recover whatever thickness of oil is within the streams, all the way down to the thin sheens on the outer edges of the oil streams.



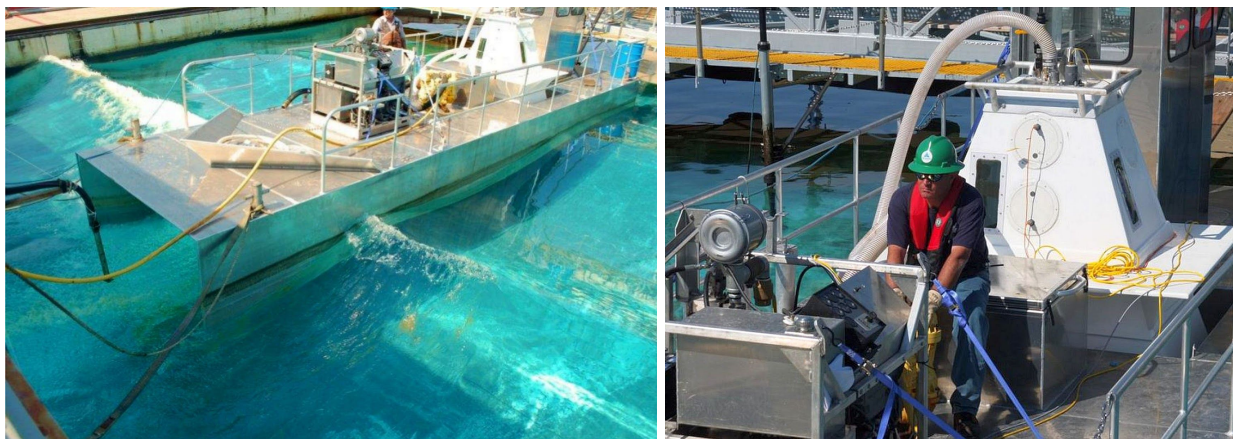
9 August 2020: image from French Defense Ministry showing 200,000 gallons of oil leaking from the Wakashio. Mauritius declared a "state of environmental emergency" after the Japanese-owned ship ran aground on 25 July. ASSOCIATED PRESS

RESTCo has been monitoring oil spill response capabilities, particularly in the Arctic offshore context for years. A RESTCo principal (Dr. Bill Adams) and associates have worked in oil spill research from the 1970s Beaufort Sea Project onward. RESTCo arranged for the reprinting and making available on-line the summary reports and technical papers from the Beaufort Sea Project. RESTCo co-hosted, with the Canada Science and Technology Museum, the Ottawa

Forum in September 2011. RESTCo has delivered submissions to the Canadian National Energy Board, the UK House of Commons and the US National Research Council related to oil spill consequences and response. Dr. Adams travelled to Russia as an invited scientist in 2012 and visited Siberian oil and gas areas as well as making presentations in Moscow and St. Petersburg on impacts of oil and gas developments in the Arctic and potential methods of response to accidents. He has also testified before a Canadian Parliamentary committee as an expert on oil spill consequences and response. RESTCo is currently participating in international standards setting activities for oil spill environmental monitoring in the Arctic on behalf of Canada via the Canadian Standards Association Group. One of RESTCo's principals is a former Coordinator for the Canadian Nuclear Liability Act (equivalent to U.S. Price-Anderson Act), and has worked on emergency response and preparedness at a level not yet imagined by the oil and gas industry.

RESTCo currently has a contract with the National Geographic Society to explore the use of oil spill response technology for the removal of microplastics from water in the environment that includes the skimmer technology being proposed in the current White Paper.

In the course of our investigations to date, RESTCo has identified an innovative technology for oil recovery for water-based spills that has been tested in the Ohmsett facility in the USA and found to be very effective (up to 94.4% of oil recovered in single pass), and especially in moderate wave conditions which is much better as compared to other vessels and technologies. (see Ref 3 and Figures below).



*Photos of gravity separation technology based 40 ft EST skimmer tests at Ohmsett in 2012*

RESTCo made a proposal to BSEE as a result of a previous successful White Paper submitted to BSEE, "Enhancing the EST Gravity Oil Skimmer for Use under Arctic Conditions", under BSEE Solicitation Number E15PS00027 in May 2015. However, although BSEE expressed a strong interest in our proposal, they reported to us that it was not successful as BSEE ran short of funds.

The RESTCo equipment being proposed in this White Paper is based on the gravity separation technology described above. However, the size of these skimmers are specifically designed for rapid deployment to a spill scene and can be moved by road on trailers without escort. The design is intended for mass production to provide a low-cost vessel for multiple applications for everyday use. The concept is to spread these vessels along the coasts likely to suffer from oil spills. Most importantly, the equipment can be used as utilitarian gear for other applications near

a potential spill site, and refitted to oil spill response configuration in considerably less than an hour with minimal tools or labour effort. With converting the oil spill response industry to one that genuinely cleans up and at a lower cost, as opposed to just rendering a spill less visible and at a high cost, comes the advantage of recovering a non-renewable resource for commercial gain as well as for its obvious environmental advantage.

### **Principal advantages of the RESTCo skimmer to recover thin films and sheens**

1. Only recovering sheens is an advantage for our present 23 ft skimmer, as it doesn't require much storage for recovered oil and extra could be handled by towing a small bladder behind each skimmer with infrequent changes of bladders when they are full.
2. RESTCo has conducted tank tests of the gravity separation technology and has video evidence that the technique can remove oil from the surface of water even in the form of sheens.
3. Of course, we can also perform a complete oil spill response with our same 23 ft skimmer, recovering oil of any thickness floating on the surface with a more intensive effort of more frequent replacements of towed bladders, given that they would be filled more quickly.

### **RESTCo proposes to carry out these specific pieces of work for the BSEE**

1. Complete the RESTCo skimmer design with our marine architect and build two 23 ft prototypes to be tested at Ohmsett utilizing the patented gravity separation system. If necessary, adjust the existing design to comply with BSEE requirements.
2. Demonstrate that the 23 ft skimmer design can be rapidly configured from its multiple use utility workboat role to an oil spill response vessel transportable by trailer to enable shipping the vessel to spills either on the coast or offshore.
3. Explore the concept of multiple skimmer swarm operations to rapidly remove oil from water including the removal of oil sheens.
4. Based on empirical data obtained from the activities above, and analysis of real-world spill events to date and testing the system on real oil spills, develop a credible 'Tier 0' response capability including equipment, management structure, materials, techniques, training, pre-deployment requirements, response and escalation protocols, including coordination with existing first responders in proximity, guidelines for drills and rehearsals, addressing worker health effect issues, and means of mitigating health and environmental effects.

### **What RESTCo wants from BSEE**

1. Funds to build two 23 ft skimmers.
2. Funds to enable transport of the skimmers and technical support from RESTCo to test the skimmers at Ohmsett.
3. Funds to do Operations Research and simulations related to the use of the skimmer technology in swarms and as autonomous vessels during oil spill response operations.

4. As it is illegal to dump real oil into the environment for testing and evaluation purposes, in the event there is a spill of opportunity during the project period in North American waters, BSEE would facilitate the inclusion of the RESTCo skimmer vessel in the spill response operation through to remediation, and fund the transportation and operational expenses for that exercise.

### **Assumptions that RESTCo is challenging**

1. Experience with oil spill response indicates that booms don't contain oil spills in even moderate currents > 1 knot and moderate waves, while a large number of our 23 ft skimmers could recover oil from spills in high current or wave conditions in which conventional booms/vessels/skimbers are unable to collect oil.
2. The gravity tower can recover any thicknesses of floating oil spills, all the way down to very thin films and sheens.
3. The gravity tower separates > 90% of the oil from water, as per previous tests at Ohmsett, reducing the amount of recovered water-oil mixture that needs to be transported to shore and its costs of treatment and disposal.
4. Rapid response of 23 ft skimmers, beginning to arrive within a couple of hours by road and starting to recover oil, rather than waiting for a 50 ft vessel to arrive days later to begin to recover oil. Tidal currents require an oil spill response that is shorter than the time in which the oil spill is likely to be carried onshore.
5. A large number of inexpensive 23 ft skimmers are scattered around the continent with economies of scale of production, being used for multiple tasks, such as harmful algae and microplastics cleanup, that could be reassigned quickly to oil spill recovery, drastically reducing the cost of oil spill response compared to storing oil response equipment in warehouses for infrequent oil spill responses.
6. The skimmers could respond to oil spills in lakes and rivers from oil pipeline leaks and truck/boat/barge accidents anywhere near where our skimmers are operating.
7. Our 23 ft skimmer is beachable to support multiple onshore cleanup technologies and techniques, allowing our skimmer to handle the complete gamut of offshore to onshore cleanup including the using the skimmer pump for spraying of bioremediant on oil to enhance the final removal of the oil from the environment.
8. A floating bladder can be towed behind the 23 ft skimmer that wouldn't unduly impede the oil recovery performance of the skimmer with the bladder being quickly replaced by a separate crew tasked with replacing bladders and bringing filled bladders to shore with the recovered oil, which would be largely water-free and potentially a valuable commodity.

**What's changed regarding our skimmer since the last test at Ohmsett with the 40 ft EST gravity tower skimmer**

1. 23 ft gravity tower skimmer is able to be transported rapidly by road without permit or escort, unlike the original 40 ft skimmer. Response time is critical.
2. Operating a large number of 23 ft skimmers as a coordinated swarm at the oil spill with or without floating booms that permits us to follow and recover thin streams of oil that are being carried by strong tidal currents, unlike booms that can't contain oil spills with currents > 1 knot, once they are encircled, or can't be encircled, if the oil spill disperses too far before the booms can be deployed.
3. Operating skimmers without crews is distinctly feasible because of the simple technology, when necessary, to enable the assets to be used in highly toxic environments and allowing operation in more severe sea states that would be unsafe.
4. Multifunction skimmer boats are distributed densely throughout the world to ensure that response by road from the closest communities is rapid and that response cost is greatly reduced versus using dedicated costly oil spill response equipment sometimes requiring warehousing and expensive large single-purpose vessels at a few widely-spaced locations.

**Test Plan**

1. Validate the seaworthiness of our skimmers in offshore waters.
2. The collection efficiency and capacity of the skimmers for thin films including sheens will be tested at the Ohmsett facilities.
3. Test the oil recovery performance of our skimmers in real-life oil spills in open water in not less than 12 months, as opportunities arise.

**References**

1. <https://www.forbes.com/sites/nishandegnarain/2020/08/31/fear-of-second-major-oil-spill-in-mauritius-as-oil-barge-overturms/#502c71d17085>
2. Satellite images of the oil spill dispersal for the first 22 hours after the container ship MV Cosco Busan struck the San Francisco-Oakland Bay Bridge in thick fog in 2007  
<https://www.youtube.com/watch?v=EHTsVD6b13Q>
3. Ohmsett Sept. 2012 – Tank Tests Video of EST 40ft×10ft skimmer vessel.  
<https://www.restco.ca/GravityTowerOhmsett.mp4>

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