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Currents

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rubber Navy Divers Retrieving
reef Tires from Failed Osborne
recycled Artificial Reef

Navy Commemorates International Year of the Reef 2008
San Clemente Island Training for the Future, Preserving the Past
NAVFAC ESC Produces Disinfection Byproduct Guide



Navy Divers Retrieving Tires from Failed Osborne Artificial Reef

**rubber
reef
recycled**

The crystal blue water and extensive beaches of Fort Lauderdale, Florida seem like an unlikely spot for old tires. Over the years tires from a failed artificial reef have been washing up on Florida beaches. But thanks to the cooperative efforts of Coastal America, the Navy's Mobile Diving and Salvage Unit 2 (MDSU 2), and other federal and state partners, the Osborne Reef is finally evolving from an unsuccessful artificial reef venture to a training opportunity for military salvage teams and a recycled fuel source for Georgia and Florida.

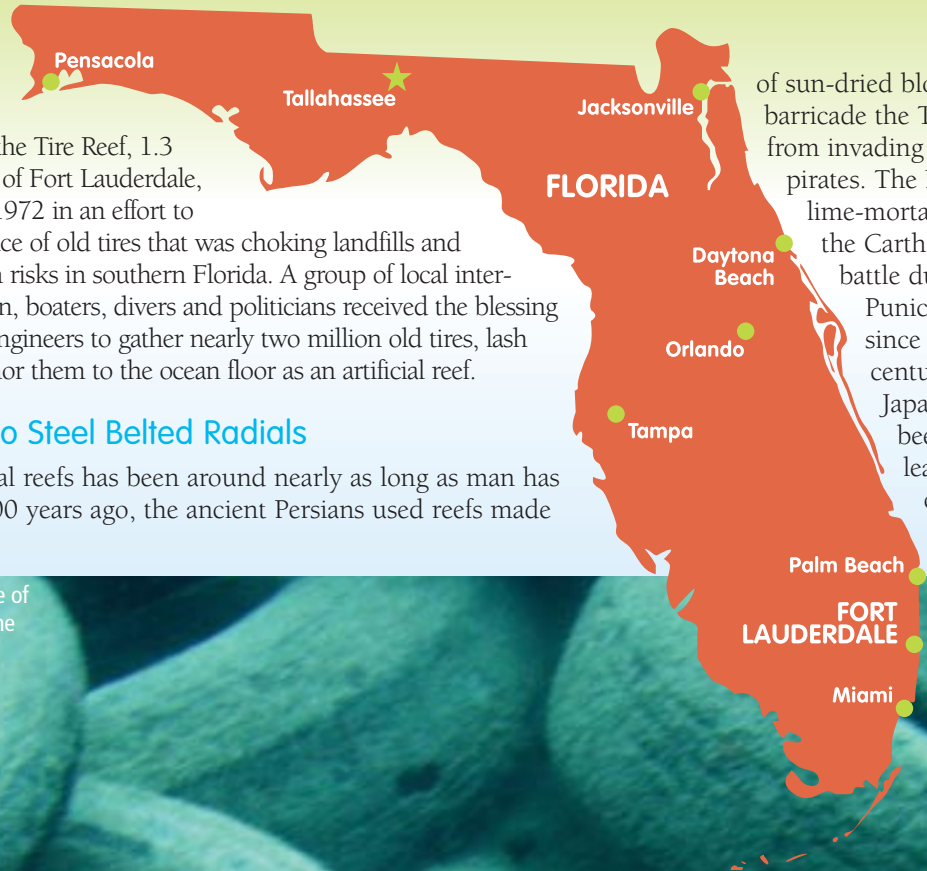


he Osborne Reef, or as it may be better known, the Tire Reef, 1.3 miles off the coast of Fort Lauderdale, was conceived in 1972 in an effort to resolve an overabundance of old tires that was choking landfills and creating potential health risks in southern Florida. A group of local interests, including fisherman, boaters, divers and politicians received the blessing of the Army Corps of Engineers to gather nearly two million old tires, lash them together and anchor them to the ocean floor as an artificial reef.

Sun Dried Bricks to Steel Belted Radials

The concept of artificial reefs has been around nearly as long as man has gone to sea. Over 2,000 years ago, the ancient Persians used reefs made

of sun-dried blocks of clay to barricade the Tigris River from invading Indian pirates. The Romans used lime-mortar reefs to trap the Carthaginians in battle during the First Punic War, and since the 18th century the Japanese have been world leaders in artificial reef tech-



This tiny fish represents one of the few specimens of marine life one can find along the Osborne Tire Reef.





Photo by
William Nuckols
(©2007)

did you know?

Millions of tires have been dumped into our oceans, and thousands of them have washed up on shore around the world. According to a 2005 Ocean Conservancy report on its annual international coastal cleanup effort, more than 11,000 tires were removed from beaches that year.

nology for commercial fishery enhancement. The first Japanese artificial reefs used weighted bamboo frames. More modern versions are constructed of materials such as high quality concrete, steel and glass-reinforced plastic.

Artificial reefs have been created by ships, army tanks, oil rigs and washing machines. What most intentionally placed materials have in common is a hard and varied surface that can provide shelter for fish and a substrate to which corals, sponges, algae and mollusks can attach.

The National Fishing Enhancement Act

The National Fishing Enhancement Act of 1984 was written to “promote and facilitate responsible and effective efforts to establish artificial reefs...” in order to enhance commercial and recreational fisheries. The Act requires the development of a National Artificial Reef Plan to enhance fishery resources, increase fishery production, and benefit coastal economies by encouraging “properly designed, constructed, and located artificial reefs” based on the best scientific evidence. The plan includes general criteria and guidelines for siting, materials, design, and construction of artificial reefs, and suggested mechanisms and methodologies for permit compliance, monitoring, and managing reefs. It is intended to provide a framework for use by state, regional, and local planners in developing detailed, site-specific plans.

Tires as Reefs

Tires as reefs were appealing for two reasons. First, during the 1960’s and 1970’s used tires were accumulating in landfills after restrictions on other disposal methods were imposed. Second, by grouping large numbers of tires together, the openings would provide shelter for fish and other species.

But tires have a certain amount of buoyancy, causing them to move and eventually break loose of their restraints. And their slick surfaces appear to be more attractive to a limited range of algae than coral and other more beneficial reef organisms.

As hurricanes moved through each hurricane season, and other storms and currents pulled at the Osborne Reef tires, their nylon and steel lashings eventually gave way. Within three years of their placement, tires had been moved by regional storms. Eventually, the tires spread over roughly 34 acres, began washing up on beaches and, more critically, damaging nearby natural reefs.

Solutions Sought

As the tire reefs’ failure became apparent, scientists and conservationists pondered how to get the Osborne Reef tires out of the

ocean. In the simplest terms, the solution comes down to three issues:

1. Who has the legal authority to manage the project?
2. Who has the technical expertise to perform the task?
3. Who will pay for it?

Projects on this scale easily run into the millions of dollars and no one single agency or government could finance the operation.

In 2001, Robin Sherman of NOVA Southeastern University initiated a small-scale tire retrieval pilot program after receiving a \$30,000 grant from the National Oceanic and Atmospheric Administration (NOAA). Approximately 1,600 tires were retrieved at a cost of \$17 per tire. That cost alone made a full-blown project cost prohibitive.

The Osborne Reef was conceived in 1972 in an effort to resolve an overabundance of old tires that was choking landfills and creating potential health risks in southern Florida.

Productive Partnership

Two federal programs that have cooperated on other projects seemed to offer a possible answer. The Coastal America program is a federal program that coordinates resources from various federal agencies to help address needs in coastal communities. The Department of Defense (DoD) Innovative Readiness Training (IRT) provides the military with a way to gain hands-on training while providing benefits to communities.

In 2006, Coastal America project coordinator William Nuckols contacted the Broward County Department of Environmental Protection (DEP). He suggested that Coastal America coordinate with Broward County DEP on a major project to remove the tires and in

The Basics About Florida's natural coral reefs

Florida's natural coral reefs began forming 5,000 to 7,000 years ago when sea levels rose following the last Ice Age. The Florida reef tract, composed of outer reefs and patch reefs, contains over fifty species of corals comprising over eighty percent of all the coral reef species in the Tropical Western Atlantic and over one hundred fifty species of fish. The reef tract starts near Miami and extends southwest to the Dry Tortugas, about 67 miles west of Key

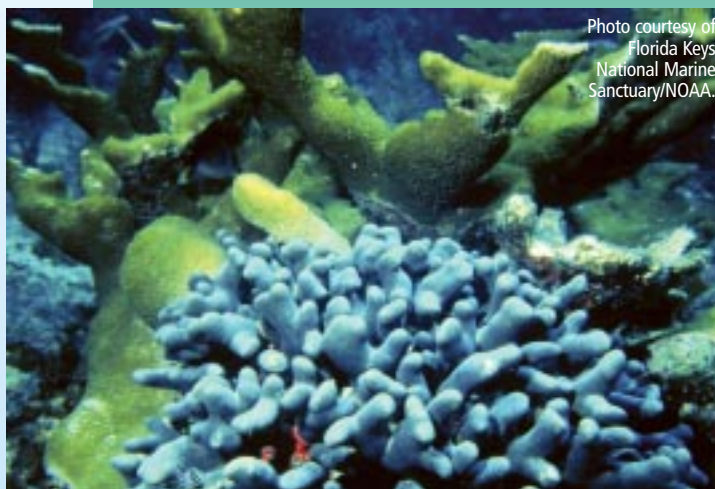


Photo courtesy of Florida Keys National Marine Sanctuary/NOAA.

West. Patch reefs continue up through the Palm Beaches, just north of Fort Lauderdale.

Florida waters also are home to numerous artificial reefs. There are currently 1,843 artificial reefs in state and federal waters off of Florida, which accounts for at least half of the artificial reef systems in the United States. In general, an artificial reef is a structure put into place on the ocean floor to create marine habitat. Artificial reefs are often placed to enhance fishery resources and to provide commercial and recreational reef opportunities, including fishing and diving.



The Army LCU-2000 El Caney serves as the mission command center and collection platform for the tires, while SCUBA dive operations were run from Navy Rigid Hull Inflatable Boats (RHIBs) and other small craft.

Photo by William Nuckols (©2007)



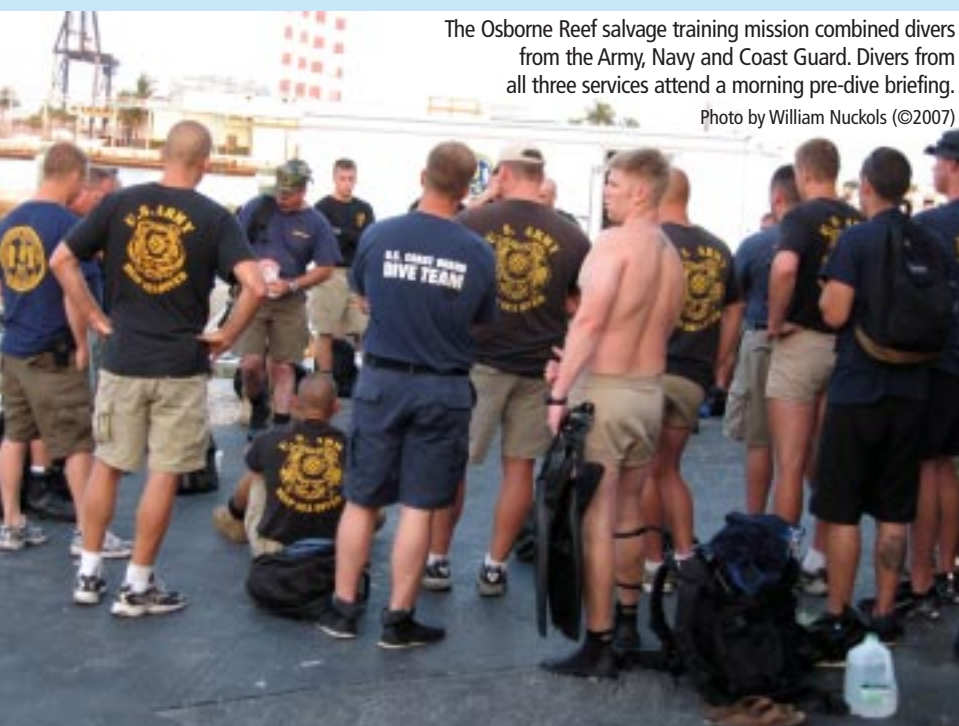
LEFT: A MDSU 2 diver receives instructions and a safety check before submerging to the reef.

August 2006 the NOAA Marine Debris Program funded a reconnaissance project for developing a tire removal and disposal strategy. The project removed only 30 tires, but it enabled the participants to determine processing suitability, handling, staging, transportation methods and end uses for the reef tires. It also made clear that a project of this magnitude can't just be done as a volunteer effort and that removing only a few tires wouldn't alleviate the problem.

Nuckols suggested that this type of project might fall within IRT guidelines and proposed contacting the military about the project as a training exercise. He recognized that Navy divers from MDSU 2, located at the Naval Amphibious Base Little Creek in Norfolk, Virginia, had the qualifications and experience to handle a job of this size and scope. He contacted the MDSU 2 Operations Officer and asked for unit divers to come to Florida and dive the tire reef in order to determine whether the tire reclamation project would have value from a real-world training mission point of view.

The Osborne Reef salvage training mission combined divers from the Army, Navy and Coast Guard. Divers from all three services attend a morning pre-dive briefing.

Photo by William Nuckols (©2007)



For a military unit to determine a project's suitability under IRT, a unit commander must, among other things, ensure that the project:

1. Consists of activities **essential** to the accomplishment of military readiness training and offer **incidental** benefits to the community in which the training activities occur.
2. Provides support and services that: (a) in the case of assistance by a unit, will accomplish valid unit training requirements; and, (b) in the case of assistance by an individual member, will involve tasks directly related to the specific military occupational specialty of the member and fall within the member's scope of duties.

(Source: Innovative Readiness Training Guidelines, Office of Assistant Secretary of Defense, Reserve Affairs, 1999.)



CWO2 Donovan Motley, MDSU 2, at the helm of a joint Navy, Army, Coast Guard dive team two miles offshore.

Photo by William Nuckols (©2007)

If a project meets the training objects, the unit commander submits a proposal through the chain of command for approval before work can begin. The tire reef project offered multiple training components, including salvage diving at depths

The Basics About the Navy's **mobile diving** & salvage units

Within the Navy Expeditionary Combat Command (NECC), MDSU divers are deployed globally to perform specific tasks within eight major areas of operation. NECC has 95 commands located within 13 states and nine countries, many of which have positions for Navy divers. While some commands perform dive duties as a primary function, others operate with dive capabilities as a subspecialty. Navy Explosive Ordnance Disposal is a good example.

There are two MDSU units in the Expeditionary Salvage and Harbor Clearance dive command: MDSU 1 services the Pacific Fleet, while MDSU 2 tends to the Atlantic Fleet. Both units have helped in the recovery of boats, planes, and even spacecraft. MDSUs provide:

- Mobile ship salvage
- Towing
- Battle-damage repair
- Deep-ocean recovery
- Harbor-clearance demolition
- Expeditionary Combat Salvage
- Emergent underwater ship repair
- Repair of Vessels
- Underwater Construction Teams

For more information about NECC, visit www.necc.navy.mil.





William Nuckols, Project Coordinator and Military Liaison, Coastal America, is interviewed for a segment on Discovery Channel Canada and by Rusty Dornin of CNN.

Photos by Lauren O'Connor and MC1(SW) Phil Beaufort



for more information

For more information on Coastal America visit www.coastalamerica.gov. Additional information about the DoD Innovative Readiness Training can be found at www.defenselink.mil/ra/html/irt.html.



of 60 feet or more. More importantly, it offered experience in logistics and communication coordination (i.e., interoperability) with multiple federal, state and county agencies. Specifically, the project involved the Navy, Army, Coast Guard, the State of Florida and Broward County. Each has its own policies, procedures and terminology, all of which had to be coordinated for safety and project success. The ability to develop a coordinated approach quickly is critical in emergency situations, such as natural disasters.

Once word spread that a cleanup effort was underway, community volunteers and supporters came forward to offer help.

“By aligning military salvage training exercises with this real world problem we are accomplishing a coral protection project that government natural resource agencies would not have been able to accomplish on their own,” Nuckols said.

Having determined suitability, secured funding for travel and completed required applications, Chief Warrant Officer (CWO4) Dan Mikulski lead a team of six MDSU 2 divers to Fort Lauderdale. Mikulski, along with the other divers from his unit, dove the reef and performed a site survey.

“Once we completed the site survey we came up with a plan to complete the mission and determine the number of tires we could bring up per day,” Mikulski said.

Local Interest

Fort Lauderdale residents have seen tires wash up on their shores for almost 30 years—not realizing that they were coming from a reef a little more than a mile off shore. Once word spread that a cleanup effort was underway, community volunteers and supporters came forward to offer help.

“Even in Broward County where the tire reef is located, most people down there including the dive shops, didn’t know it existed even though it covers almost 34 acres,” Coastal America coordinator Nuckols stated.

A photographer and some local reporters covered the site survey, resulting in widespread reporting of the clean-up. Beginning with a Miami Herald article by Susan Cocking, 27 August 2006, and continuing through September 2007, every major news outlet in the country had picked up on the cleanup effort from USA Today and Fox News to the trade publication Rubber and Plastics News.

The Project Gets Rolling

After the State of Florida committed two million dollars to transport and recycle the tires, MDSU 2 support was approved and the Army and Coast Guard were onboard, the project could proceed. Beginning 1 July 2007, MDSU 2 led a salvage mission to remove nearly 1,000 tires a day, from the start of the mission until 30 September 2007. Supporting the effort were diving and watercraft assets from the Army’s 7th Transportation Group,

naturally formed coral reefs

Coral reefs, one of the more intriguing and in some ways contradictory environments on earth, have been forming without the help of humans for thousands of years. Natural coral reefs form as tiny marine animals called polyps colonize a hard substrate on the ocean floor. The reefs grow as generations of polyps build upon old coral and are joined by other reef-dwelling species including calcareous algae, sponges, soft corals, seagrasses and mollusks. Covering less than one



percent of the ocean floor, reefs support roughly twenty-five percent of marine life. While coral reefs are sufficiently robust to absorb the immense energy of the sea, thereby helping to protect nearby land, they also are fragile and easily damaged by human activities. Colonial, reef-building corals are found both in warm, relatively shallow and light-filled waters, as well as in deep, cold water areas.



Before the inflatable lift-bags can be raised to the surface they must be secured to a harness and chained to the lifting mechanism.

Photo by CWO4 Dan Mikulski and NDCS (MDV) Dave Schoepfersterof



A U.S. Navy Diver attached to MDSU 2 prepares a lift bag to salvage tires from the Osborne Reef.

U.S. Navy photo by Mass Communication Specialist 3rd Class Jack Georges

for more information

To learn more about natural coral and artificial reefs, visit the following web sites:

- The NOAA National Ocean Service Education at: <http://www.oceanservice.noaa.gov/education/kits/corals/welcome.html>
- The National Artificial Reef Plan at: www.nmfs.noaa.gov/sfa/Partnerships/Communications/NARPwCover3.pdf
- The Broward County Florida website: www.co.broward.fl.us/bio/reefs.htm



National Artificial Reef Plan (An Amendment) Guidelines for Siting, Construction, Development, and Assessment of Artificial Reefs



two Coast Guard detachments from Homestead, Florida, the Broward County DEP, and the State of Florida. Coastal America provided guidance throughout this initial stage of the project.

During the retrieval process, divers work in approximately 60-70 feet of water and have to place 50-70 tires in 4,000 pound cargo lift nets under water. Then, using inflatable airbags, they float the tires to the surface where a crane mounted on an Army Landing Craft Unit (LCU) lifts them out of the water

onto two 48-foot trailers. Divers can stay submerged for no longer than 50 minutes, 45 minutes of which is performing the work and the last five minutes is for safe decompression prior to surfacing.

The Navy's dive team leader Mikulski pointed out that the rigorous work the divers are performing limits the amount of time they can stay under water. The heat also plays a factor, as summer ocean water temperatures in Florida can reach 80 degrees. Compounding the problem, the salvage divers wear full body suits to protect themselves from marine life such as stinging hydroids and jellyfish. The insulating properties of the suits can cause divers' body temperatures to rise, which may lead to fatigue or other health issues.

This tedious cleanup of between 500,000 and one million tires from a 34 acre area is expected to take nearly seven years.

This tedious cleanup of between 500,000 and one million tires from a 34 acre area, equivalent to about 31 football fields, is expected to take nearly seven years. Each year, work is slated to begin on 15 May and continue for 90 days to minimize conflicts with the end of Florida's tourist season and avoid working in rough seas at the beginning of hurricane season. So far, the cooperation among the various groups has resulted in a seamless tire cleanup project that can continue as planned at a cost of two dollars per tire, a significant savings from the previous 17 dollars per tire estimate.

tropical reefs

Warm, tropical ocean waters where extensive reefs comprised of hundreds of types of coral can be found are surprisingly low in available nutrients. Although coral can feed on minute, free-floating plants (phytoplankton), these warm-water corals depend on symbiotic algae called zooxanthellae. The algae convert sunlight to energy, providing an additional energy source in the nutrient-poor tropical waters. Under adverse conditions, including increased water temperature, the host coral might expel the algae on



which it depends. If the resulting coral bleaching is sustained, the coral will die. Healthy corals, however, form a foundation for remarkable abundance and diversity.



The surface crew observes a bundle of tires emerging from the tire reef below.

Bundles of tires are raised to the surface with 4,000-pound lift bags, then a crane hoists the tires aboard an Army LCU during the joint Navy, Army, Coast Guard salvage training mission.

Photo by William Nuckols (©2007)



for more information

For more information about the Navy's other MDSU-MDSU 1 and their efforts to rescue the damaged Chinese-flagged motor vessel Tong Cheng in 2007, read our article entitled, "Navy Divers Complete Critical Repairs to Chinese Vessel: Emergency Response Prevents Major Fuel Spill" in the summer 2007 issue of *Currents*.



Tires for Fuel: Local Recycling

An important part of the operation is not only getting the tires to the surface (a role for the Federal government), but then being able to dispose of them through an entirely different entity (the responsibility of state and local officials). The tires are transported to Port Everglades and ultimately shipped to Georgia, typically for processing into either an energy resource for cement kilns or municipal solid waste facilities. The tires can also be chipped and used as light weight fill-in aggregate for highways or turned into tire-derived fuel (TDF), displacing fossil fuels providing energy for power plants and paper mills.

The Miami Herald actually prints its newspaper on recycled paper from one of the mills to which cut up Osborne Reef tires have been shipped for use as TDF.

“The weirdest connection is that I’m reading a story in Miami, a story produced by the Herald, written on recycled paper produced by a plant in Georgia where we send the tires,” Nuckols notes. “It shows how things can come around full circle.”

The tires can be chipped and used as light weight fill-in aggregate for highways.

For decades, tire reefs have been created near coastal states and around the world. And though well-intentioned, people now realize the negative effects those tires can have on the marine environment. Fortunately, technology now allows old tires to be recycled, providing needed energy sources, reducing waste disposal issues, and minimizing the potential for those tires to harm the ocean. With the cooperative efforts of Coastal America, the Navy, and other federal and state partners, the Osborne Reef is finally evolving from an unsuccessful artificial reef venture to a training opportunity for military salvage teams and a recycled fuel source for Georgia and Florida. ⚓

deep reefs

Unlike their warm-water counterparts, deep reefs are formed by far fewer types of coral. These include members of the true corals: the stony corals (*Scleractinia*), the true soft corals (*Octocorallia*), black corals (*Antipatharia*) and members of the



Hydrozoa, the lace corals (*Stylasteridae*). Deep reefs form in depths from 130 feet to more than 3,200 feet and occur in such dissimilar locations as the Gulf of Mexico and Norwegian fjords. Because the ocean regions where deep-water corals are found are more nutrient rich than tropical areas, these corals do not rely on symbiotic algae to convert energy into food. They do support a wide-range of plant and animal species, many of which are commercially valuable.



Tires are stacked aboard an Army LCU on the surface before being ferried to Port Everglades where they will be further transported for recycling and reuse.

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