R/V *Cape Hatteras* Biofuel Experiment: Waste Vegetable Oil for Diesel Power

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ABSTRACT

A pilot study was carried out to determine if used vegetable oil could be used as diesel fuel for a generator on the R/V *Cape Hatteras*. Oil was obtained from restaurants in Morehead City, NC and stored at the Duke University Marine Laboratory. The oil was filtered and then heated to ~180^0 before being delivered to the engine. Prior to shutdown, the vegetable oil was purged from the engine and fuel line by switching to diesel fuel before the generator was shut down.

The experiment was successful and ~300 gallons of oil have been used at dockside to provide 4 days of hotel load power. The primary challenge to using used vegetable oil is the logistics of collection, storing, and transfer of the oil.

METHODS

•The used vegetable oil was collected from a number of restaurants in Morehead City, NC and transported in a 350 gallon tank mounted on a 16' boat trailer.
•The oil was stored in the tank until needed and then transferred to the ship, where the used cooking oil was held in an empty/unused tank (~400 gallon capacity) located in the engine room port side aft (Figure 1).
•The oil was filtered (10 micron) before being transferred into the holding tank and then again via the fixed generator fuel oil filter.
•The aft generator (3406 CAT) was started and warmed up on diesel fuel.
•The used cooking oil was heated via a generator jacket water heat exchanger to ~180 degrees before being delivered to the engine (Figure 2,3).
•A three way valve (Figure 4) was used to switch from diesel fuel to used vegetable oil.
•Prior to shutdown, the engine was switched back to diesel fuel to prevent the "trumpeting" of the fuel oil injector nozzles and fouling of the supply lines.

Figure 1. Used cooking oil tank onboard vessel.

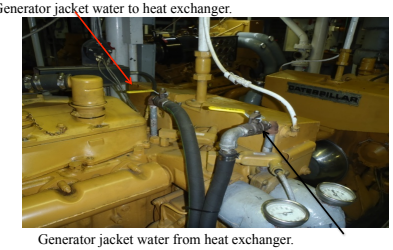

Figure 2. Generator jacket water.

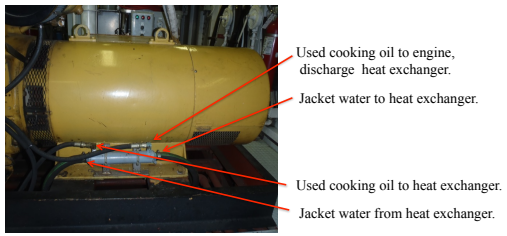

Figure 3. Cooking oil heat exchanger.

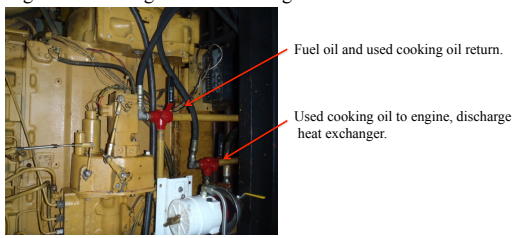

Figure 4. 3-way fuel oil / used cooking oil valves.

R/V *Cape Hatteras*

R/V CAPE HATTERAS	
Built:	1981, Atlantic Marine Ship Builders
Length Overall:	135 feet, 41 meters
Beam:	32 feet, 9.7 meters
Draft:	10 feet, 2.7 meters full load
Gross Tonnage:	296

•The R/V *Cape Hatteras* is owned by the National Science Foundation, operated by the Duke/University of North Carolina Oceanographic Consortium, managed by Duke University and is a member of the University-National Oceanographic Laboratory System.
•The R/V *Cape Hatteras* is a regional class vessel that operates along the eastern coast of the United States, the Gulf of Maine to the coast of Florida, the Caribbean Sea, and the Gulf of Mexico.
•The R/V *Cape Hatteras* supports basic oceanographic research funded by:

- National Science Foundation (NSF)
- Office of Naval Research (ONR)
- United States Geological Survey (USGS)
- Naval Oceanographic Office (NAVO)
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CONCLUSIONS

* Used vegetable oil was successfully used as a biofuel to run a 3406 Caterpillar generator.
* The oil needed to be filtered and pre-heated before introduction into the generator.
* It was concluded that the greatest challenges for use in the R/V *Cape Hatteras* are to find reliable suppliers and transportation and storage of the used vegetable oil.