

Tracking the Trail of Oil

WHOI instruments see tiny things in a big ocean

When oil began spewing from the Deepwater Horizon/Macondo well, scientists sought quick information on where the oil was traveling in the depths and how it might be affecting tiny marine life. Biologist Cabell Davis hurried to the Gulf of Mexico with two unique instruments he developed at Woods Hole Oceanographic Institution (WHOI).

He and Nick Loomis, an MIT/WHOI Joint Program graduate student, took their new digital Holographic Plankton Observation Device: the HoloPOD. They had created it to identify and measure microscopic phytoplankton and zooplankton and their eggs and larvae in the water. But they readily adapted the HoloPOD to take images and measurements of similarly tiny oil droplets in the Gulf.

The HoloPOD's information is essential to create a more accurate picture of how and where plumes of oil move in the ocean, said Debbie French-McCay, director of impact assessment services at Applied Science Associates Inc. (ASA), who is leading the ASA effort to model the plume.

"The oil droplet size determines where the plume will go," said French-McCay. "If they're small, the plume is transported deep,

for a long distance—like a diffuse fog—but if they are larger, they'll go to the surface."

The HoloPOD tracked size changes in the oil droplets, which affected the plume's behavior. "The plume location changed each day as currents shifted," Davis said.

Davis returned to the Gulf aboard different ships in July, August, and September of 2010, and as recently as the spring of 2011. He brought the HoloPOD and his other specialized instruments, called video plankton recorders, or VPRs, which take color images of small plankton and particles of organic matter.

"The plankton can be sensitive indicators of changes in the environment and a first measure of how the oil might affect the ocean food chain," said Loomis (see Page 12).

HoloPOD images taken in the Gulf of Mexico include (from top) a fish egg, a zooplankton, and an oil droplet. Data on oil droplet sizes are being used to model how oil moves through the ocean.



Courtesy of Cabell Davis, WHOI

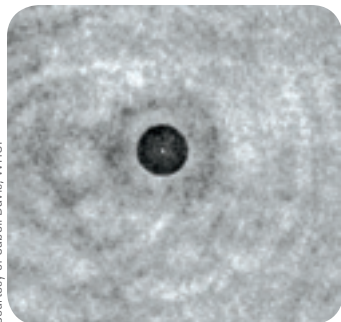
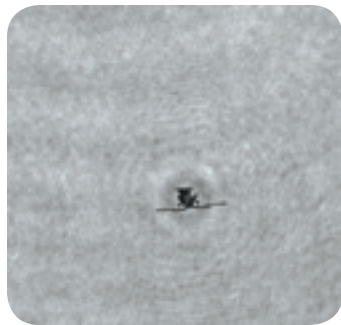
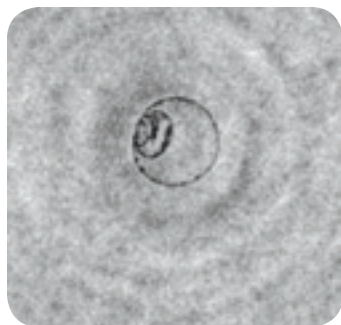
WHOI biologist Cabell Davis prepares the HoloPOD, an underwater holographic imager, aboard the ship *Jack Fitz* in the Gulf of Mexico.

Davis has used a free-swimming digital autonomous video plankton recorder and a version called the VPR II, which moves up and down in the ocean as it is towed behind ships at fast speeds. Both VPRs can be used to survey larger areas than the HoloPOD can, "so that we can get information about plankton in the wider Gulf region, not just the spill site," Loomis said.

Aboard the WHOI research vessel *Oceanus* in March and April 2011, Davis used the VPR II to survey the Gulf's continental shelf from Florida to Texas. He collected 3,500 vertical profiles through the ocean measuring temperature, salinity, and chlorophyll, while gathering 8 million images over 3,408 nautical miles.

—Kate Madin

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Courtesy of Cabell Davis, WHOI



Phil Alatalo, WHOI

Towed behind ships, the sleek-looking Video Plankton Recorder II takes color images of microscopic marine life.