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Camera spots hidden oil spills and may find missing planes



Any oil here?
Mlenny/Getty

By David Hambling

There are thousands of oil spills each year in US waters alone. One major source is illegal dumping of oil in harbours when ships empty their bilges, typically at night to avoid detection. However, a new kind of polarising camera can now spot offenders immediately. Its ability to detect otherwise invisible oil sheens could even lead investigators to lost planes.

Like many oil imagers, the Pyxis camera sees the infrared radiation emitted by all objects. That is important because there is often a temperature difference between oil and water. However, if there isn't one, thermal imagers don't work. So the Pyxis has another trick up its sleeve: it also detects differences between the way oil and water scatter light. Thanks to this differing polarisation, it works not only when the oil and water are the same temperature – but also in pitch darkness.

This is the first time a polarising infrared filter has been made for terrestrial use. Infrared polarimetry is used in astronomy to help identify distant stellar objects, but nowhere else as previous devices were slow, fragile, hefty and expensive. Only astronomers can afford to use big, immobile set-ups and focus long exposures on stationary subjects. The Pyxis camera, developed by Polaris Sensor Technologies in Alabama, changes this.

“The optical system and the physics behind it are very complex,” says company president David Chenault. “We started building infrared polarimeters several decades ago, but they were bulky and not capable of looking at dynamic scenes.” Only in the past few years did it become possible to significantly shrink the sensor – now roughly the size of a fist – and make it capable of imaging moving scenes. That is important for detecting oil on water.

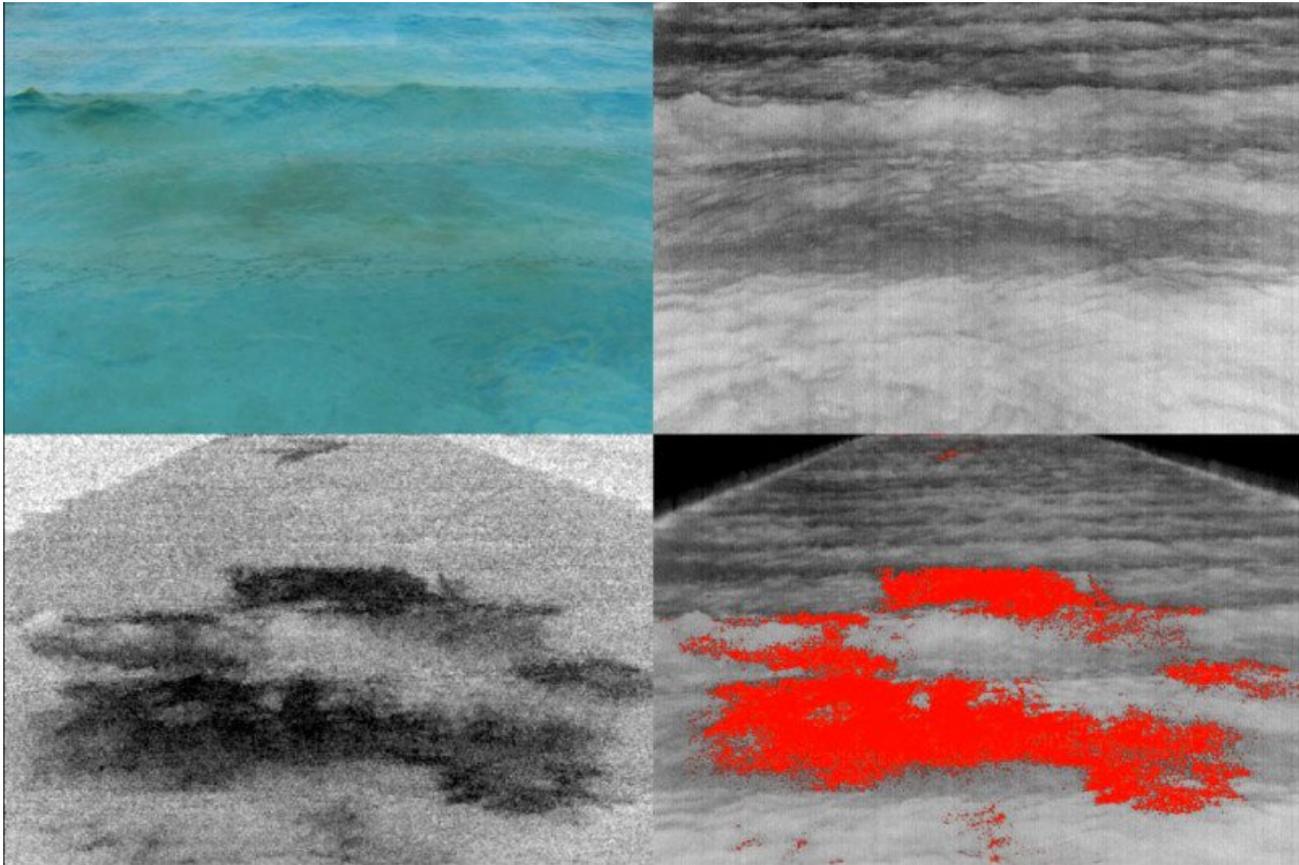
The new camera can see spills invisible to the naked eye from 2 kilometres away. Its size means it can be mounted on a small drone or other robot.

Slick device

Doug Helton of the National Oceanic and Atmospheric Administration Emergency Response Division says these cameras could augment NOAA satellite networks, which detect and track suspected oil spills. While they can spot even small spills, visual confirmation is crucial to rule out false positives. “Wind shadow may look like an oil slick,” he says.

Confirmation is usually done by people in a helicopter or plane, so that is where a drone-mounted camera could save a lot of time.

The camera can also spot and track oil washed up on beaches. Typically, this is a time-consuming task that must be done by people on the ground.



Oil can be hard to distinguish from water using visible and infrared imaging, but the Pyxis camera clearly shows it in red
Polaris Sensor Technologies

The sensor passed extensive tests with crude oil and diesel in different wave conditions at the massive Ohmsett test facility pool in New Jersey and at an actual spill off Santa Barbara, California, in 2015. Russell Chipman at the University of Arizona says this is a significant development. "The costs of polarimeters are decreasing," he says, and the miniaturisation and commercialisation of infrared polarimetric sensors means this technology can now be deployed widely to detect all kinds of oil slicks.

Chenault says this may be useful for locating planes lost at sea, which leave a trail of aviation fuel on the surface. As such slicks are difficult to spot by eye, searchers currently look instead for floating debris. However, false positives from unrelated flotsam are common.

While Polaris is currently concentrating on oil detection, more applications for the camera are likely to be discovered when it goes into mass production, anticipated early next year.

One of these is facial recognition. Using polarised infrared imagers may offer more reliable and consistent recognition than unpolarised infrared. Crucially, it works in any lighting so the subject doesn't need to be well-illuminated.