

# FLOTATION DEVICE

If you're building sensors for monitoring waterways, mount tiny propellers on a bunch of cell phones.

When a levee is leaking and about to blow, there are warning signs. The salinity level might go haywire as seawater trickles in. Or the water temperature can start to look wonky. But chances are you'd never see these changes if all you have in your river delta is a few stationary sensors on posts. And old-fashioned floating sensors get swept away like rubber duckies (or get snagged on trees) in surging floodwaters. The solution: a flotilla of controllable data-gatherers you can deploy to vulnerable areas, to relay info back in real time.

That's exactly what a team at UC Berkeley is developing, with the help of repurposed smart-phone parts. The goal of their aquatic network—100 programmable units equipped with processors, sensors, batteries, and tiny propellers—is to help scientists map crinkled shorelines and monitor emergencies like floods and contaminant spills. Here's a look at the bits and pieces that make up each drifter. —Erin Biba

## ANATOMY OF A SELF-GUIDED SENSOR

### GPS AND MOTOROLA G24 CELL PHONE MODULE

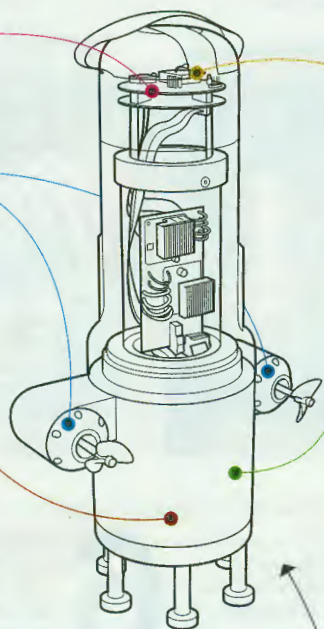
Relay geotagged data in real time over a GSM network to an online server.

### TWIN MOTORS

Traveling about a foot per second, the unit can steer itself, say, to a place where there might be a tributary. In the future, a buoyancy-control system will even let it dive below the surface.

### DEPTH FINDER AND SALINITY SENSOR

Onboard instruments gather information on water conditions. Knowing salt levels in areas where rivers and seawater collide, for example, helps assess the health of estuaries.



### SHORT-RANGE RADIO

Enables drifters to keep tabs on one another so as to avoid collisions or fan out to measure an area.

### LITHIUM BATTERY

Powers the whole setup. "The challenge is to use as little propulsion as possible," says Alexandre Bayen, the project's principal investigator. One way to save juice: Start the devices upstream of their destination and make small movements as they move downstream so they don't have to fight the current.



## JARGON WATCH

### Deceit perfume

*n.* \ di-'sēt 'pər-fyūm \

An aerosol that works like an air freshener to conceal the acrid smell of gunpowder. Developed for the Iranian military, the spray is available in scents like fresh air and seaside weather — as well as tea fragrance, intended for use by the police.

### Glymphatic system

*n.* \ glim-'fa-tik 'sis-təm \

The hydraulics used by the brain to flush out neural waste products. It's similar to the body's lymphatic system, only made of the brain's own glial cells. When it fails, the brain accumulates toxic proteins associated with Alzheimer's.

### Facekinis

*n. pl.* \ fās-'kē-nēz \

Face masks designed to be worn at the beach. Pierced with small eye-holes, the colorful Lycra headgear have become a fashion statement in China, where suntans are associated with farmwork.

### Anternet

*n.* \ 'an-tər-'net \

The protocol by which harvester ants regulate their foraging, recently discovered to use essentially the same TCP algorithm as the Internet.

—Jonathon Keats

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A grad student deploys floating sensors on California's Sacramento River.

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