

## Great Blue Engine

### Dawn Wright is pioneering powerful new tools to study Earth's troubled oceans

The ocean shimmers to the curved rim of the Earth. Pressing her face against the jetliner window, Dawn Wright scans the azure expanse for a glimpse of her destination, a tiny volcanic archipelago that is barely a blip in the vast South Pacific. At 5,000 miles from Wright's office at Oregon State University, American Samoa is closer to New Zealand than to Hawaii.

The year was 2001, and the geosciences professor was on her way to the outer reaches of Oceania to study a marine sanctuary with funding from the National Science Foundation's POWRE (Professional Opportunities for Women in Research & Education) program. Using state-of-the-art sonar equipment mounted on a small survey boat, she and a team of oceanographers from the University of South Florida "pinged" clusters of sound beams into the crystalline waters of Fagatele Bay. The beams, fanning out from the echo-sounder, would hit the seafloor and bounce back. How fast depended on depth. These acoustic readings produced the sanctuary's first precise seafloor map.

The mapping, though, was just one facet of the mission. As an international innovator in marine GIS — geographic information systems — the OSU professor was laying the groundwork for a sweeping storehouse of data about Samoa's sanctuary. Science and policy-making are severely stymied, Wright points out, when data are skimpy and scattered as they are on this distant shore.

Despite Samoa's unique isolation, it is not alone in its dearth of data. Wright sees this small tropical atoll, in fact, as a microcosm of a global deficit in comprehensive ocean information. The answer, she says, is a new era in ocean data management built on the "seamless merging" of data into a Web-based clearinghouse. But towering hurdles stand in the way. For one thing, ocean systems are immense and mostly hidden. For another, they span multiple dimensions of time and space. In ceaseless flux, their chemical, biological, physical and socioeconomic facets overlap and interact to create one of science's most intractable puzzles.

"The three-dimensional nature of the marine domain, the temporal dynamics of marine processes and the hierarchical interconnectedness of marine systems grossly increase the complexity of developing and applying geospatial solutions to marine management questions," Wright cautions in the 2005 book, *Place Matters*, which she co-edited with Astrid Scholz of Ecotrust.

### Approximating Nature

In American Samoa, the need for data is acute. As the most remote of the U.S.'s 13 national marine sanctuaries, Fagatele Bay sees far fewer scientists than its sister sites, such as the Florida Keys and California's Monterey Bay. Yet even here on the fringes of human habitation, in what might appear to be a pristine paradise, the marine ecosystem is in trouble. A voracious, coral-eating starfish species, the crown-of-thorns (*Acanthaster planci alamea*), ravaged the reef in the 1970s, killing 90 percent of the coral. It was this disaster, in fact, that spurred the site's designation as a sanctuary. The bay's tentative recovery suffered a setback in 1992 when Hurricane Val unleashed monstrous seas that scoured the reef, oblit-

OSU Professor Dawn Wright emerges from the *Pisces V* after a successful dive to the corals of Taema Bank off the south coast of Tutuila, American Samoa. (Photo: Emily Lundblad)



erating huge sections. Then in 1993-94, El Niño bathed Samoa in abnormally hot water for several months, bleaching out the reef's pinks, reds, lavenders and yellows, leaving it bereft of color.

Rich and fragile ecosystems like Fagatele Bay can recover. But their return to health may be thwarted, scientists warn, by human actions. Pollution, development, over-fishing, dredging and shipping all impinge on the ocean's regenerative processes. "One of the greatest threats currently facing Fagatele Bay, as well as much of Samoa's coastal waters, is the depletion of fish stocks by the illegal use of gill netting, spearfishing, poison and dynamite," Wright wrote in her 2002 book, *Undersea with GIS*. "In addition, the sanctuary staff is concerned about the potential for algal blooms with subsequent

incidents of hypoxia (low oxygen) due to unchecked sewage outflow 'upstream' from the bay."

Efforts to stop harmful practices are hindered by data gaps. Making the first-ever bathymetric (underwater) map of the Samoan sanctuary was a critical step in filling that gap. Wright has since led teams of scientists for subsequent studies funded by NSF and NOAA to map wider and deeper swaths of the area, and to collect photos and videos. Their discoveries include nine small underwater volcanoes, a dozen new fish species and several creatures previously unknown in Samoa, strange and startling animals such as the six-foot black-blotched stingray and the doughboy starfish (also known as a "lounging pillow").

In the intervening years, Wright has relentlessly pushed her bigger vision: a revolution in data management across oceanography, geography and geology. The status quo — piecemeal, nonstandardized, fragmented data collections strewn among disparate agencies across disciplines and jurisdictions — simply isn't adequate to address the global crisis in ocean health, Wright says.

A Web-based repository would capture data that describe the dimensions of time and space, from geologic time to real time,

from the ooze of a million millennia to the vents and volcanoes that are bubbling and erupting right now, from the sunlit surfaces to the lightless depths. It would capture patterns and interactions, chains of predation, paths of migration. Winds, currents, tides, waves. Satellite signals, acoustic soundings, sediment cores, ice cores. Whale beachings, earthquakes, tsunamis, hurricanes, off-shore drilling.

When woven into an electronic tapestry, the clearinghouse would give scientists, resource managers, fishermen and conservationists fingertip access to simulated ocean systems from anywhere on earth.

### A Mother's Mantra

That these intricate, interlocking events and systems exist in 320 million cubic miles of saltwater sloshing across 70 percent of the planet doesn't daunt Dawn Wright. That they take place within the constant flux of fluid, the never-ending heave, roll, pitch, yaw and swell that have been the undoing of many a landlubber, doesn't spawn intimidation in her heart, but determination.

Wright's intrepid spirit took hold early. Her sun-drenched Maui childhood, body surfing and boogie boarding in the frothy breakers, was wrapped in a relentless, sky's-the-limit mantra from her mother, Jeanne, who taught

speech at the University of Hawaii. "You can be anything you want to be," she would tell her daughter, over and over.

At age 8, transfixed by the televised moon walk, Dawn briefly mulled a space career. But another TV experience tipped the scales toward ocean science: "The Undersea World of Jacques Cousteau." "I was riveted," she says. And, as the waves surged relentlessly around her island home, she spent many afternoons reading deep-sea adventure stories. Captain Nemo, Robinson Crusoe, Long John Silver: these were the characters that filled her imagination. So no one was surprised when little Dawn switched dreams, from astronomy to oceanography.

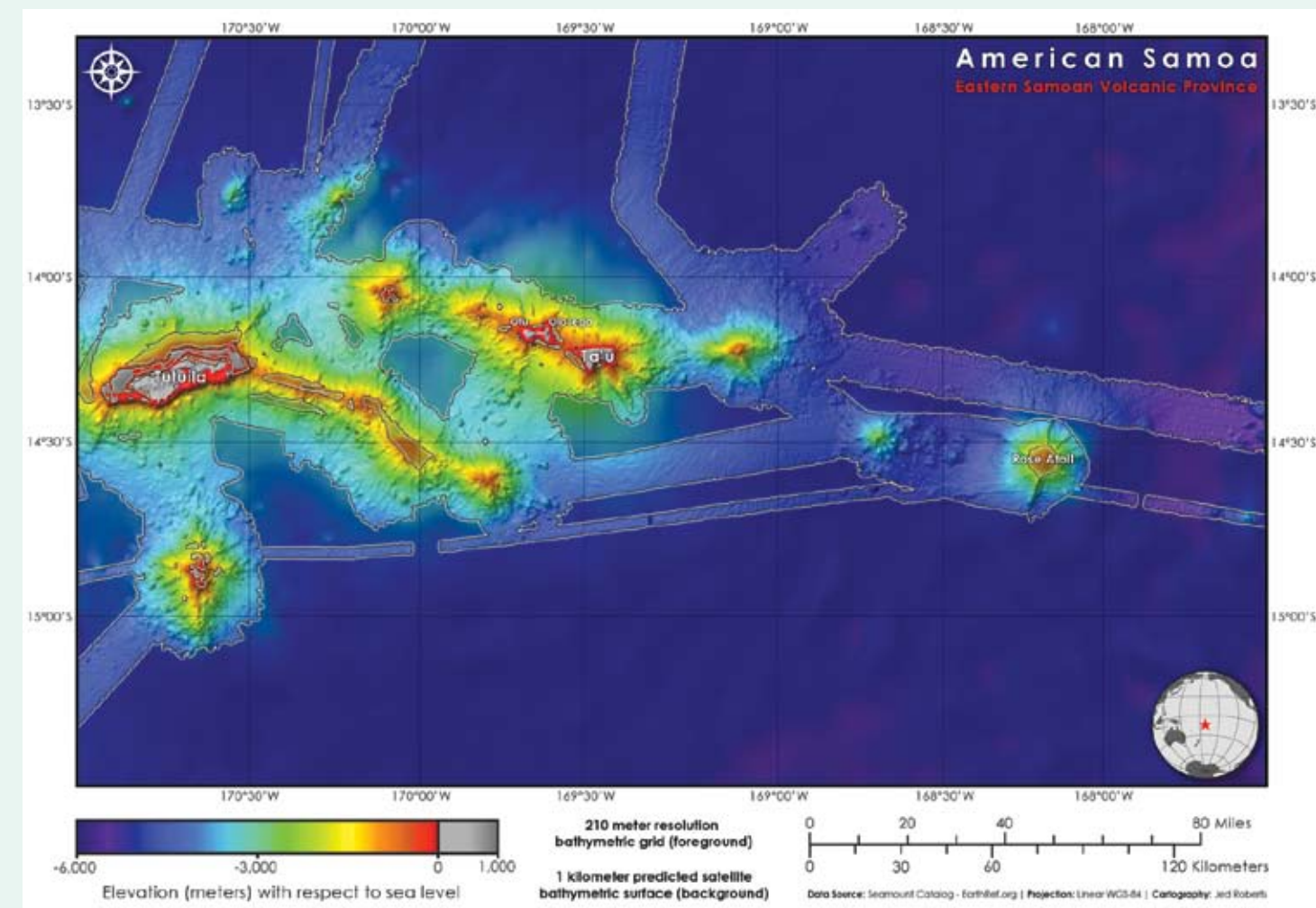
She didn't realize then that soaring miles above the Earth in a space capsule bears an eerie resemblance to sinking fathoms beneath the sea in a submersible. Both explorations take place in cramped, pressurized chambers launched into dark, inhospitable places where only advanced technologies can sustain human life. In 1991, as the first woman of color to dive in the three-person autonomous craft ALVIN, Wright watched as the filtered sunlight faded to total blackness outside her porthole and felt a kinship with the space travelers of her girlhood daydreams.

"When you go down in a submersible, it feels very much like being an astronaut," she says. "You're going through this alien world, but it's inner space instead of outer space. It has that wild, exploratory feeling."

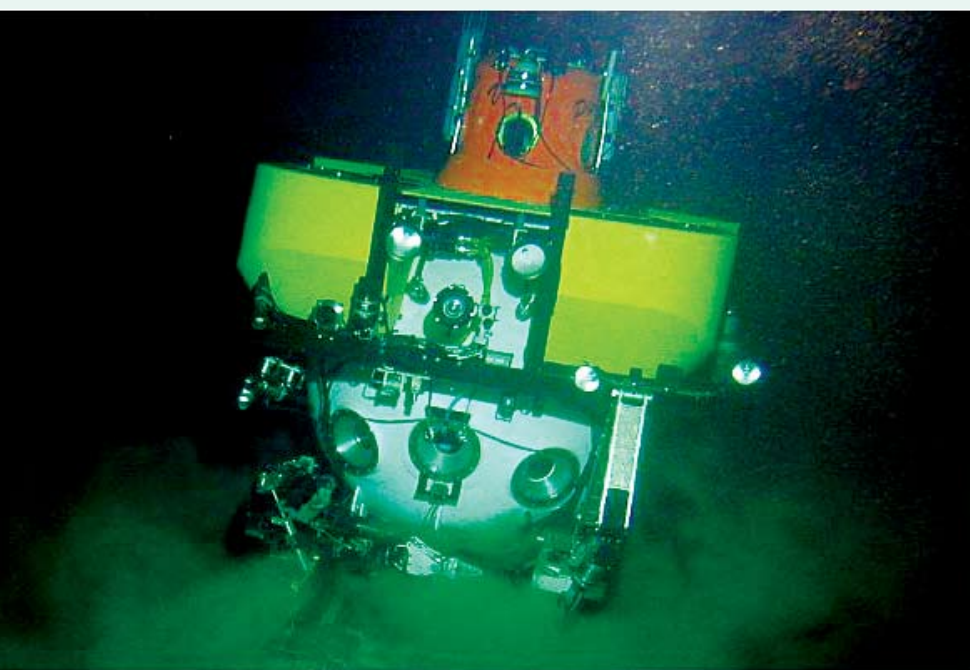
With reefs dying and fisheries collapsing across the globe, a profound sense of urgency propels Wright's energies, which have expanded from deepwater geology to near-shore ecology. Accurate predictions — and sound policy — about the "great blue engine" that powers the planet depend, she says, on getting the data right.

BY LEE SHERMAN

**Samoan sanctuary** View Dawn Wright's Web clearinghouse of American Samoa data at [dusk.geo.orst.edu/djl/samoa](http://dusk.geo.orst.edu/djl/samoa)



The bathymetry (seafloor topography) surrounding the American Samoa archipelago is displayed in a compilation of data collected at sea by the Scripps Institution of Oceanography, the University of South Florida and Oregon State University, as well as satellite altimetry estimates. (Visualization by Jed Roberts, a graduate student in Dawn Wright's Davey Jones Locker seafloor mapping/marine GIS lab)



In American Samoa, OSU Professor Dawn Wright used the Pisces V submersible to map the seafloor. The Pisces V is operated by the Hawaii Undersea Research Lab and NOAA's National Undersea Research Program. (Photo: Hubert Staudigel, Scripps Institution of Oceanography, taken from the Pisces IV)

## Researcher Profile

**Dawn Wright** is a professor in the Department of Geosciences and an adjunct professor in the College of Oceanic and Atmospheric Sciences. She has completed oceanographic fieldwork in some of the most geologically active regions on the planet, including the East Pacific Rise, the Mid-Atlantic Ridge, the Juan de Fuca Ridge, the Tonga Trench, volcanoes under the Japan Sea and the Indian Ocean, and, most recently, American Samoa. She specializes in the application of geographic information systems to the marine environment and is co-author of "Arc Marine: GIS for a Blue Planet" (in press), as well as lead editor of the books "Marine and Coastal Geographical Information Systems" (2000), "Undersea with GIS" (2002), and the OSU Press book "Place Matters: Geospatial Tools for Marine Science, Conservation, and Management in the Pacific Northwest" (2005). Her research has received funding support from various divisions within the National Science Foundation and the National Oceanic and Atmospheric Administration. In addition to colleagues at OSU, she collaborates with scientists at the University of South Florida, the Scripps Institution of Oceanography, the Monterey Bay Aquarium Research Institute, the Irish Coastal and Marine Resources Centre, and the Oregon Ocean-Coastal Management Program.

## Contact Information

### **Dawn Wright**

Professor, Department of Geosciences  
Phone: 541.737.1229  
dawn@dusk.geo.orst.edu

### **Sherman Bloomer**

Dean, College of Science  
Phone: 541.737.4811  
Fax: 541.737.1009  
Sherman.Bloomer@oregonstate.edu

### **OSU Foundation**

800.354.7281  
OSUFoundation@oregonstate.edu