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THE PULSE of PARADISE

STATION ALOHA

Habitat for ocean observation

A circle in the Pacific 12 miles across gives scientists a laboratory for studying the sea

By Timothy Hurley
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"Aloha" is the Hawaiian word for love and affection, commonly used to say hello or goodbye and sometimes combined with other words to express a fond Hawaiian greeting.

Sixty miles north of Oahu, at a lonely spot in the Pacific Ocean known as Station ALOHA, the word has a different meaning: "A Long-term Oligotrophic Habitat Assessment."

On the surface, the acronym doesn't quite capture the heartfelt spirit of the word. But listen to the scientists who oversee and conduct experiments at Station ALOHA and you'll learn there's no shortage of aloha for the far-flung open-ocean field site and its contribution to science. ("Oligotrophic" refers to environments without a lot of nutrients.)

"I would love to go out there more often," said Ricardo Letelier, an Oregon State University oceanography professor who has conducted research at Station ALOHA for years. "It's a place of high-quality research and excellence for researchers from around the world. Look at the long list of research papers (using data collected there). It's an amazing list."

This year marks 25 years

Please see ALOHA, A8



COURTESY PAUL LETHABY

Scientists on a research vessel lower a conductivity-temperature-depth rosette into the ocean at Station ALOHA. The device takes water samples and a variety of other measurements at different depths.

Lack of clues stymies hunt for missing Malaysian airliner

International search teams scour the ocean for debris that might show that the plane crashed

By Thomas Fuller
New York Times

SEPANG, MALAYSIA >> More than two days after Malaysia Airlines Flight MH370 vanished, the mysteries over its fate have only multiplied.

The Beijing-bound plane made no distress call, officials said, and the Malaysian authorities suggested it might have begun to turn back to Kuala Lumpur in midflight before it disappeared. Despite an intensive international search effort in the waters along its scheduled route, there were no confirmed sightings of the plane's wreckage. And electronic booking records showed that the two passengers who were traveling on stolen passports bought their tick-

INSIDE

>> **Stolen passports:** Interpol sounds the alarm about bogus travel documents. A12

ets from the same Thai travel agency.

The seeming security lapse, which Interpol publicly criticized, might have had nothing to do with what happened to the jet and its 239 passengers and crew. Investigators said they were ruling out nothing, including a catastrophic mechanical failure, pilot error or both.

By early Monday the search effort had yet to confirm where the plane might have gone down, even as military aircraft and a flotilla of ships from a half-dozen nations searched the waters south of Vietnam.

Azharuddin Abdul Rahman, the Malaysian civil aviation chief, said samples from an oil slick discovered in the water had been collected and were being tested to determine whether they had come from the plane.

Vietnamese ships working throughout the night could not

Please see PLANE, A12

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ALOHA: Oceanographers gauge man-made changes

Continued from A1

since University of Hawaii oceanography professors David Karl and Roger Lukas established Station ALOHA in a 6-mile-radius circle in the ocean at 22 degrees 45 minutes north latitude, 158 degrees west longitude.

Since then the remote outpost has become legendary. As part of the Hawaiian Ocean Time-series program, known as HOT, it has offered up an invaluable long-term record of the chemistry and biology found at a typical deep spot in the subtropical North Pacific.

Just about every month over the last quarter-century, scientists from all over the globe have climbed aboard a research vessel in Honolulu and set sail for Station ALOHA on a mission to conduct open-ocean experiments and take measurements of the currents, water chemistry, optical properties, plankton community and more.

Station ALOHA's most noted achievement is its contribution to the science of climate change. Its data has mirrored the atmospheric measurements taken at Mauna Loa Observatory, where the Keeling Curve has illustrated the ongoing change in concentration of carbon dioxide in Earth's atmosphere since 1958 and which first alerted the world to the possibility of human contribution to the "greenhouse effect" and global warming.

At Station ALOHA, scientists have recorded the oceanic version of the Keeling Curve: a rise in near-surface ocean carbon dioxide plus a corresponding ocean acidification. The data have been included in reports issued by the United Nations'

International Panel on Climate Change and featured prominently in the latest 25-page summary of findings provided to policymakers.

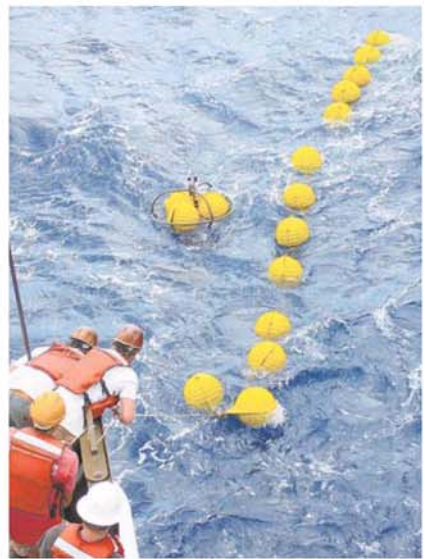
"Humans are influencing the oceans in many ways, and measurements made at Station ALOHA are helping us understand and document how ocean ecosystems are responding to these changes," said Matthew Church, UH oceanography professor and HOT program principal investigator.

The HOT program was founded in 1988 after funds were awarded by the National Science Foundation. At the time, scientists were attempting to come to grips with the signs of global warming.

"Back in '87 the meteorologists did their thing, and the oceanographers were doing their thing," said Karl, who is now director of UH's Center for Microbial Oceanography: Research and Education. "There wasn't a general understanding of the planetary scale of climate change."

IN SEARCHING for a site to establish Station ALOHA, Karl and Lukas looked for a location far enough away from the islands to be free from coastal influences yet close enough to the port of Honolulu to make relatively short monthly cruises logistically and financially feasible. The spot needed to be deep, and representative of the entire ocean.

On Oct. 26, 1988, Karl and Lukas set out for Station ALOHA in a cruise that didn't exactly foreshadow the success to come. A lot of the equipment failed. Sediment traps, for example, were deployed and monitored, but shortly before the



contraptions used to measure sinking particulates were supposed to be collected, they went missing. After searching for them for 16 hours, they gave up.

"Unless I'm wrong, somewhere in the middle of the North Pacific are some sediment traps drifting from HOT 1, which when recovered will be a valuable commodity on eBay as a collector's item," Church said.

Looking back, Karl said he was expecting the Station ALOHA monitoring and experiments to last five, maybe 10 years.

"After 10 years we thought we would have a pretty good understanding of the ocean and that maybe we would move on to some other challenge," he said. "But after 10 years we were just uncovering some of the mysteries — and nobody wanted to stop either looking or supporting."

The National Science Foundation funding kept on coming — and so did the science. There have been 261 cruises to Station

ALOHA, each four days in duration, involving 15 research vessels. Nearly 70 percent of those cruises have been led by non-UH scientists.

As of the beginning of this year, there have been some 620 peer-reviewed scientific publications that have relied on HOT program research. Science conducted at Station ALOHA has supported at least 20 doctorate theses and numerous master's degree candidates, while undergraduate students have logged more than 3,500 days at sea.

"When you're first told about Station ALOHA, you think there's a disco ball out there," said Eric Grabowski, UH oceanography researcher. "You think there's a platform, that it's this glorious place. But in reality it's just a GPS location in the ocean."

Grabowski, who has sailed on about 50 cruises, some as chief scientist, said Station ALOHA is the perfect place to conduct ocean research because of the

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COURTESY PAUL LETHABY

Oceanographers retrieve a sediment trap, above, pulled from the sea at Station ALOHA. The trap captures sinking particles in the ocean. At left, scientists deploy floats attached to another sediment trap.

wealth of data.

"I love it," he said. "I still like it, and hopefully I'll go on some more cruises."

Over the years, a growing number of scientists and their experiments joined the Station ALOHA community.

IN AUGUST 2004, Station ALOHA became home to a surface mooring outfitted with instruments for meteorological and upper-ocean measurements. The project is a collaboration between UH and the Woods Hole Oceanographic Institution in Massachusetts.

In 2011 the ALOHA Cabled Observatory was installed on the sea floor at Station ALOHA. It offers real-time observations of sound, temperature, salinity and currents from nearly three miles below the ocean's surface via a fiber-optic cable that comes ashore at Makaha.

Over time, Station ALOHA became world-renowned. "Legendary" is how Peter Brewer of the Monterey Bay Aquarium Research Institute described it in a 2009 commentary in the Proceedings of the National Academy of Sciences.

Letelier, from Oregon State, said the fact that the HOT program has won continual funding for 25 years is testament to the importance and relevance of the science conducted at Station ALOHA. "It's a remarkable accomplishment, given that we're talking about one place in the sea, and we've learned so much," said Church, the UH professor.

The program has received funding through its 30th year — in 2018. Capturing

"After 10 years we thought we would have a pretty good understanding of the ocean and that maybe we would move on to some other challenge. But after 10 years we were just uncovering some of the mysteries — and nobody wanted to stop either looking or supporting."

David Karl
Oceanography professor,
University of Hawaii

more funding is never assured, especially considering how expensive it is. The program runs on an annual budget of \$1.4 million, plus \$1 million a year for ship time.

"I don't see the program reaching 30 years and ending," Church said. "Once you stop a time series, you can't

go back. Quite frankly, if it were to stop, that would be a tragedy. It is one of the major hallmarks of international oceanography, and I think people would fight hard to see it continue.

"Without the time series, without the historical measurements, we have no way of knowing how the planet is changing. So these programs are absolutely essential to our understanding of change."

Station ALOHA was featured last month in a special session at the biennial Ocean Sciences Meeting in Honolulu. Eight oral presentations and 18 posters described research and the sustained observations over a quarter-century.

Karl, who has worked at UH for 30 years, said he'd like to think the future of the program is bright. Already, researchers in the next generation of scientists are taking up key roles.

The cruises, meanwhile, will continue to welcome not only researchers from around the world, but also local high school students, teachers and other visitors.

"That's why we picked the name ALOHA," Karl said. "We wanted to welcome people."

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