



Humboldt Harbor and Jetties

lat: 40.6142, lon: -124.2022

# TREACHEROUS MAW

How two jetties,  
even a-crumble,  
shape Humboldt Bay  
and our lives

By Heidi Walters

It's a calm, blue-sky day out here on the north jetty — the sort of day when the sun's heat actually reaches the skin. The wind is slight. The ocean's a quiet rumble in the Humboldt Bay entrance channel, between here and the south jetty — moving just enough to elicit languid dingding-dingding from a nearby buoy atop which a couple of sea lions are flopped out, barking. Faraway traffic on the mainland sounds like sand pushed around in gentle surf: *shhhhhhh*.

A motorcycle, gunning through the nearby Samoa Dunes, briefly breaks the spell.

Then it's back to gentle water and wind, air-drifting pelicans and the mesmerizing call-and-response of the foghorns, north jetty to south jetty. A family — two little kids and their parents — clambers onto the uneven parapet along the north jetty's channel-side edge and steps carefully along it as a fishing boat in the channel glides out to sea. A trio walking on the jetty below the wall stops to watch surfers catch the easy waves rolling to the beach on the north side of the jetty. A surfer's dog trots fast down the jetty toward the beach, glancing frequently at the wetsuited specks in the water. Three fishermen sit on the jaggy boulders sloping to the channel, poles propped up as they eat their lunches. And here strolls a kissy young couple, returning from a traipse to the end of the jetty where the ocean crashes frothily all around a bristling jumble of interlocking dolosse — smooth, steel-reinforced concrete objects that look like giant Hs with one leg twisted perpendicular to the other.

Days like this, the north jetty feels like the world's grandest-kept secret of a first-class seaside promenade. Crowds: minimal; scenery: spectacular. Why, there oughta be a hot dog stand out here, and a roller skate rental booth. A —

Wait. Maybe not. The place is a mess. Full of chunked-up concrete, rotted timbers, misplaced massive boulders and slippery puddles. Lookit here, right here near the big eucalyptus grove not far past the Coast Guard station, where the jetty curves from bay into entrance: There's a gaping breach in the wall, rocks and broken concrete tumbled forward, ocean pouring in with each roll of the surf. Step unwisely there and you could be whooshed right in to be tossed about, battered and drowned. Farther up the jetty, heading toward its ocean-bound head, there are several more collapsed-in pits of sharp rock and roiling doom. One particularly deep gaper, at the beach close to the surf where trucks are known to crawl up onto the jetty, is at least fenced off. Jetty walkers have to skirt around these chaotic pits, either by gingerly hopping along the broken parapet or the angled boulders sloping from it into the channel, or on the crumbled surface closest to the beach — or down on the beach itself, a perhaps safer detour all-in-all.

What the ...? Why is this jetty in such sorry shape? Why doesn't someone fix it? It's a downright scary hazard!

Ha. Come out here on a less placid day, and then you'll see scary. Winter swells at the

entrance can reach 30 feet high — and on any day, rough or calm, there can be sneaker waves, monstrous doubled-up swells that arise suddenly. The ocean collides all around the jetty heads and then squeezes between them, rearing higher against the channel-side of the north jetty where the entrance is shallowest and crashing, overlapping, whitewashing in a series of punishing collisions. The ocean side of the south jetty gets hammered, too, with prevailing winter winds from the southwest. People — and cars — have been washed off these jetties into the brain-freezing water.

The jetties were built to tame the bay's entrance, confine it to one position and make passage through it safer for mariners. They were not constructed for lolling on sun days.

So perhaps the better question is, are those jetties holding up to their main task? Especially the more broken-down north jetty — *should* somebody fix it?

## If you drive out

to King Salmon and park near the bend where the road hooks south to head for Gill's by the Bay restaurant, you can venture northeast from that bend up a steep, short bluff for a view of Humboldt Bay. Behind you, for reference, is PG&E's power plant complex. There's an eroded scramble up to the bluff top from the beach, but also a timber-stepped grassy trail through some trees you can find by looking for the blue-and-white "tsunami evacuation route" signs near it just off the road (the bluff is the high point for King Salmon).

This is Buhne Point. There's a crappy bench on top, marred by graffiti and neglect and snugged into a knoll planted with three weathered crosses. Sit, or stand, and face the bay: Staring right back at you is its entrance — the 2,200-foot opening between the north and south spits armored by two jetties. The 6,000-plus-foot jetties hug their respective spits and then jut antennae-like into the ocean, perpendicular to shore. The bay fills and empties twice a day with the tides. At ebb tide — when the water is rushing out and the current is strongest — the pressure between the jetties "reaches nearly two million pounds of force," according to Jon Humboldt Gates in his book "Night Crossings," a dramatization of five of the dozens of harrowing vessel mishaps that have occurred at the entrance.

But this is the *tamed* entrance. Before the jetties, the opening between the north and south spits wandered with the sand-depositing currents — southward with the summer winds from the northwest, northward with winter winds from the southwest. Indigenous people living around the bay knew the entrance's fickle habits. Mariners plying the coast looking for the way in couldn't, for the longest time, even find it. Local environmental planner Aldaron Laird says that's because often the entrance was obscured by the way the spits overlapped each other. And,

a red bluff on the mainland — later renamed Buhne Point — also blended visually with the spits so that, from sea, there appeared to be no opening.

It was onto this bluff — which stuck out into the bay much farther than — that Hans Henry Buhne, at the time second mate on the *Laura Virginia*, climbed on April 13, 1850, after crossing the bar in the captain's gig into the bay.

"I went on the bluff and had a fine view of the bar, entrance and the bay," John Carr's 1891 biography, "Pioneer Days in California," quotes Buhne as saying. "The bay was literally covered with geese and ducks."

After taking soundings to find the deepest channel, he and the crew eventually guided the ship through the breakers of the sand bar and into the bay. A Russian ship had come into the bay nearly half a century earlier, but this was the first American ship to cross the bar.

It changed the region's history forever. White settlements burgeoned, tensions rose between them and the native Wiyot people — many of whom were massacred in one terrible night in 1860. Ninety percent of the bay's marshes and sloughs were diked and drained to make way for crops, livestock and eventually the railroad. Ships poured in and out of the entrance carrying goods — gold, timber, dairy — and passengers. And, regularly, ships grounded in the shallow, sand-choked entrance and were capsized by the massive breakers. Many passengers and crewmen died. Buhne's own wife drowned after being washed off one of those bar-crossing ships. And, sometimes, ships couldn't pass through the entrance at all. Local historian Jerry Rohde, who is writing a history of Humboldt County, says he's heard accounts of ships waiting two to three weeks — in the bay, or outside in the ocean — for the entrance to become calm and stable enough to venture through. "And until we had the railroad completed in 1914, almost all of the goods and supplies had to go by ships," Rohde says.

For years, residents begged the U.S. Army Corps of Engineers to fix the entrance. Finally, in 1881, the Corps conceded (a bit) and dredged a channel at the Eureka waterfront.

But dredging wasn't enough. The bay entrance still shifted about, and crossing the bar was still deadly. Installation of a lighthouse, bells and then steam whistles to guide ships in the fog did some good, and the Humboldt Bay Life-Saving Station, built in 1878 on the north spit, was there to rescue the poor souls who wrecked (a rebuilt station, the pretty red-and-white structure on the north spit today, became the home of the U.S. Coast Guard). As early as 1877, the Corps' Chief of Engineers reported that a safe entrance to the bay could only be achieved "by the construction of two parallel jetties, of very heavy stone ... from the north and south spits ... ." But that didn't happen until 1889.

They started with just one jetty that year, *continued on next page*



THOUSANDS OF DOLOSSE WERE MADE IN A CASTING YARD ON THE SOUTH SPIT BEFORE BEING TRANSPORTED TO THE SOUTH AND NORTH JETTIES. PHOTO COURTESY OF THE U.S. ARMY CORPS OF ENGINEERS



TOP IN THE EARLY 1960S, THE U.S. ARMY CORPS OF ENGINEERS PLACED 100-TON BLOCKS ON THE SOUTH JETTY. THEY WASHED AWAY WITHIN FIVE YEARS, ABOVE AN INTREPID CONTRACTOR HAULS A 42-TON DOLOS OUT TO THE HEAD OF THE SOUTH JETTY, CIRCA 1971. PHOTOS COURTESY OF THE U.S. ARMY CORPS OF ENGINEERS

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continued from previous page on the south spit. That directed too much wave action at the north spit, eroding it, so they built a second, much shorter jetty on the north spit, begun in 1891. The jetties were built of piled up stone quarried at the Mad River and, later, Jacoby Creek, and barged across the bay to temporary trestles. From there, brush mattresses — literally bound piles of compressed brush — were dropped into the bay followed by the rocks. The ocean demolished them — as it did a succession of ever-higher, longer, concrete-capped, beefier jetty reconstructions. It undermined them at their bases, whisked away 100-ton cube-shaped blocks, laughed at the smaller stones and some 12-ton tetrahedrons, and buried the jetties' heads — those extra-reinforced rounded knobs at the end of the long, narrow trunks — in the sand. Finally, in 1971, 82 years after the first jetty attempt, the jetty builders got the last laugh when they began reinforcing the jetties with dolosse — massive, steel-reinforced concrete forms patterned after a goat's ankle bone used in a children's game in South Africa, where the structures were invented. Humboldt Bay was the first place the dolosse were used in America; they were introduced here by engineer Orville Magoon, who designed these latest Humboldt jetties. The Corps piled 5,000 42-short-ton dolosse around the jetties' heads, and in 1977 dubbed the two structures a historical civil engineering landmark. In 1985, the Corps dumped another 1,000 dolosse on the jetties.

The dolosse-reinforced heads have held steady: combined with annual maintenance dredging of the bar, entrance and inner bay channels, they provide a predictable and relatively safe passage for vessels. The long trunks of the jetties, however, have slowly been ravaged by continual battering. In 1988, the Corps shored up the slopes of the jetties' trunks with 2,000 tons of stone and filled holes in the concrete caps; and in 1995, the Corps filled "an extensive void in the cap ... on the south jetty" as well as repositioned



**ABOVE** THE NORTH JETTY, ON A RARE PLACID DECEMBER DAY. **TOP RIGHT** YOU'VE GOT TO WATCH YOUR STEP WHILE AMBLING ALONG THE DECREPIT NORTH JETTY — AND KEEP AN EYE ON THE OCEAN, TOO. **RIGHT** IN THE 1990S, GEORGE TURK, WHO RECENTLY MOVED BACK TO HUMBOLDT AFTER A LONG HIATUS, WAS STUDYING THE DOLOSSE IN CRESCENT CITY AND HUMBOLDT BAY FOR THE U.S. ARMY CORPS OF ENGINEERS. INSPIRED BY THEIR EXPERIMENTS, HE AND A COLLEAGUE INVENTED THE NEXT GENERATION OF CONCRETE ARMOR UNITS FOR BREAKWATERS, JETTIES AND OTHER SHORE PROTECTION. CALLED CORE-LOC. PHOTOS BY KEN MALCOMSON



**LEFT** ROTTED TIMBERS? BUSTED PARAPET? NOT A BIG DEAL SAYS THE UNDERFUNDED U.S. ARMY CORPS OF ENGINEERS, WHICH HAS BIGGER PROBLEMS TO FIX THAN OUR UGLY BUT FUNCTIONING JETTIES. PHOTO BY KEN MALCOMSON  
**ABOVE** THE BIGGEST BREACH ON THE NORTH JETTY LETS THE OCEAN TUMBLE ON IN, NEAR WHERE THE ENTRANCE CHANNEL TURNS NORTH INTO THE BAY. PHOTO COURTESY OF JOHN POWELL, HUMBOLDT BAY BAR PILOT.

armor stones. Now, the Corps inspects the jetties annually, but its active work in Humboldt Bay consists mostly of annual dredging to keep the navigation channels open, and periodically deepening channels (the last deepening project, finished in 2000, brought the entrance's navigation channel to -48 feet). Annual maintenance dredging of the bay's bar, entrance and inner channels costs the Corps about \$5 million, \$3 million of which goes toward dredging 1,082,000 cubic yards of sediment from the bar and entrance channel. The Humboldt Bay Harbor District paid 35 percent (\$5 million) of the 2000 deepening, and the Corps paid the rest. (The district and city of Eureka spend several million every five to eight years to dredge the Woodley Island and city marinas.)

Not that Humboldt's residents haven't implored the Corps to do more.

**Earlier this year,** Lt. Col. John K. Baker, who took command of the U.S. Army Corps of Engineers' San Francisco office in June 2012, visited Humboldt County. He and members of the Humboldt Bay Harbor, Recreation and Conservation District discussed bay projects, including a proposal to study the feasibility of applying dredge spoils to part of the north spit

that's been eroding underwater. In a PowerPoint presentation overview of the district's work, put together by one of Humboldt Bay's two bar pilots, Capt. John Powell, district representatives also showed the colonel where the jetty's trunk has eroded dramatically in five locations, including the low spot at its bay end where the ocean gushes over and floods the beach during high tides and big storms. The colonel may have been impressed, but it didn't matter, said harbor district spokesperson Dan Berman.

By phone recently, from their San Francisco office, Corps coastal engineer Craig Conner and Chief of Planning Tom Kendall explained why fixing the jetties' trunks isn't a pressing matter — and why Humboldt mariners should take comfort in the dolosse at the jetty heads.

The jetties, said Conner, are doing what they were designed to do: They permanently align the navigation channel — the deep channel that hugs the south jetty; reduce shoaling at the entrance by reaching far enough out to deflect some of the current-carried sand; and reduce wave action in the entrance. As well, they create a narrow funnel that produces high flows, especially at

ebb tides, that scour out the channel.

Even so, sediment still builds up at the entrance and in the shipping channels, and that's why the Corps does repeated maintenance dredging — which it does put high on the funding priority list. Without the dredging, ships and boats eventually wouldn't be able to move about because the channels would become too shallow.

The jetties, however, don't have to be pretty.

"They are designed for overtopping, they are designed to allow water to flow through them," said Conner. "So they can have a very poor structural condition but still be very functional."

That is, the trunk — the long narrow section — of a jetty can get pretty degraded but still work. "It can appear to a layman to be 95 percent failing," said Conner, but still be 80 percent or more functional.

The dolosse on the jetties' heads are the key to this functionality, their loosely interlocking limbs providing spaces for the waves to disperse into. Orville Magoon, the engineer who designed the dolosse-

bedecked jetty heads on Humboldt Bay, said at the time that the dolosse should last 100 years. About 20 years later, in a 1994 *Times-Standard* retrospective, Magoon was said to have revised his estimate, after inspecting the dolosse again: "With proper maintenance," they should hold up much longer than 100 years.

Concrete grows stronger over time, even decades, explained Kendall — the result of a chemical reaction between the cement and water used to make it. Observations of Humboldt's dolosse showed that, though they are continually battered by the ocean, their strengthening seems to be counteracting wave fatigue. Moreover, the steel inside the dolosse keep them intact. The Corps learned more about how dolosse perform by studying the ones in Crescent City. The first dolosse installed in that city's breakwater, in 1974, were not steel-reinforced; most of them broke apart. Some of their 1986 replacements, reinforced with steel fiber, were rigged with monitoring devices so researchers could study how dolosse respond to different stresses.

"There's three types of loading that a

dolos feels out there," said Kendall.

First, a dolos experiences the stress of its own weight where it rests against other dolosse — this weight stress relaxes at high tide and increases at low tide. Second, a dolos experiences a "spiky load" of stress when waves slam into it and make it wiggle; third, when a dolos bumps into another dolos it experiences an impact stress — and that, said Kendall, is the highest stress, although the right arrangement of the dolosse can reduce it.

It was during those latter experiments with our region's dolosse in the 1990s, in fact, that one of the Corps' engineers, George Turk, and a colleague dreamed up an improvement on the dolos design. They convinced the Corps to patent the innovation, a new concrete armor unit they call "CORE-LOC." Since 1996, says Turk — who recently moved back to Humboldt County to help PG&E with its nuclear power plant decommissioning on the land connected to Buhne Point — CORE-LOC units have protected harbors and shorelines in 19 places around the world.

But Turk, on a recent ramble out to the end of the north jetty, said Humboldt's jetties don't need these new, improved units. Sure, they are less susceptible to breakage than dolosse. But the dolosse here rarely have broken. And they would be terribly expensive to replace.

"I think the time of the big civil works projects is over," Turk said. Conner, who helped inspect Humboldt Bay's structures between 2000 and 2006, affirmed that the dolosse at Humboldt are fine. But he said his team routinely recommended repairs for the jetties' long, decaying trunks.

"They were never done," he said.

The Corps has done plenty of critical work around the bay — notably, the channel deepening, but also major seawall construction, with piles of boulders called "rip rap," along the shoreline around Buhne Point in the late 1950s. The bluff, from which H.H. Buhne first studied the bay entrance to discern a path for the *Laura Virginia*, and which became a familiar navigation point for mariners, ironically was whittled to a nubbin after the jetties were built. They "created a shotgun barrel for the waves rolling in, and the waves crossed the bay and smashed into Buhne Point, eroding it," is how local planner Laird, who has mapped the bay shoreline, explains it. Buhne Point's eroded sediment, in fact, formed a new spit at Elk River Slough.

But the Corps is broke. And the jetties' trunks are low on the fix-it list — which, nationwide, right now comprises about \$40 billion worth of projects that the Corps would like to do, according to the Corps' San Francisco public affairs chief, J.D. Hardesty. But the Corps has a budget of only \$5.6 billion, "so some things go unfunded," Hardesty said. Nearly half of the Corps' annual funding goes to regions hit by hurricanes Katrina and Sandy, he added.

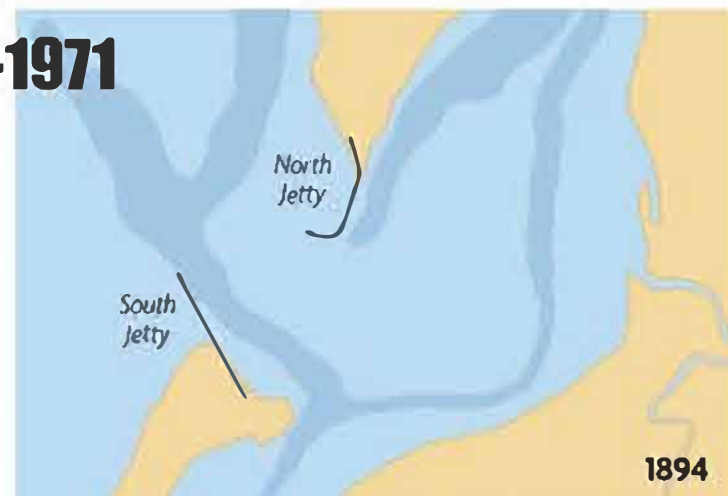
At any rate, Humboldt's jetties are hardly the worst cases out there. A jetty in another district, said Conner, has its head under water. "That was also not funded," he said.

So, yes, though the jetties aren't pretty, they're holding strong, mainly because of those odd, jumbled jacks of steel-reinforced concrete at their heads.

**The jetties redefined**  
Humboldt's human path. Today, Humboldt Bay remains the only deep-water bay and port between San Francisco and Coos Bay.

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## Humboldt Bay Jetties, 1852-1971



SOURCE: PORT OF HUMBOLDT BAY & NORTH COAST JOURNAL

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Ore., with channels deep enough to allow large ships passage — everything from log and wood chip ships to the weekly fuel barges to massive cruise ships such as 644-foot private yacht *The World*, which docked briefly in Eureka in 2012. The jetties make the port safer, including for hundreds of fishing vessels and pleasure boats.

"If you didn't know where the channel was our life would be miserable," said Powell the bar pilot, who's piloted ships in and out of the bay since 1988, and before that was a tug boat captain and engineer. "We wouldn't get cargo ships. Commercial fishermen would have a hard time getting in and out of here."

The bay's jetty system isn't perfect. If Powell could change anything, he said he'd make the entrance navigation channel line up with the jetties, "because right now there's a bend in it at the entrance." He'd also extend the south jetty farther into the ocean to block more sediment so the Corps wouldn't have to dredge so much.

And the jetties don't necessarily make crossing the bar completely safe.

"Humboldt Bay and the Columbia River are rated as the two most dangerous entrance bars on the west coast," said Leroy Zerlang, who's worked on the bay for more than 50 years, much of them operating a tug boat.

But at least there aren't major wrecks anymore, Zerlang said ("knock on wood"). Down at the north jetty, where the surf hits the sand, you can see remnants of one of those early-days wrecks: the rusted boilers of the steamer ship S.S. *Corona*, humping out of the sand like a mostly submerged hippo. It capsized on March 1, 1907; a sailor died, but the rest of the crew and passengers survived.

The terrible wrecks receded over time, though plenty still occurred after the jetties went up. Even today, occasionally a fishing boat breaks down and bumps into the jetty, requiring rescue, or a big ship careens a little into the dolosse (a pulp ship did that in 1981, but was able to keep going). The improved safety is due, in large part, to ever better navigation systems, such as weather buoys, radar and GPS; better-built boats and ships; and safety regulations such as requiring bar pilots to take large ships over the Humboldt Bay bar.

More drama seems to revolve around people recreating around the jetties: surfers getting bit by sharks, and, yes, jetty strollers being swept off their feet.

Gates, in "Night Crossings," describes how in December 1969, he and a friend parked in a Volkswagen on the end of the south jetty one day to watch the boats come in. A giant wave suddenly reared up, fell, and shoved

the car backward to the edge of the jetty. Another wave tossed it in, but Gates and his friend had already begun running toward the beach. They, too, almost were washed in.

Zerlang says a friend of his was washed off. "He was fooling around in December, a few years ago, down by the light on the north jetty," he said. "A large sneaker wave, bigger than the rest, came in and hit him. The Coast Guard saved him."

Coast Guard rescuers have risked their lives numerous times fetching folks at the jetties. In 1990, the Coast Guard commended fireman James Mounts for rescuing "a man with a broken leg clinging to a light tower" on the north jetty and "a woman with a severely lacerated face," according to the USCG's website. While rescuing them, Mounts was washed by a 12-foot wave into the dolosse and knocked out. He recovered, climbed up to the jetty pad and treated the hurt people until a helicopter arrived. In 2007, more Coasties were awarded for their valor "in a perilous rescue of a man swept off" the north jetty by a wave that February. The man was unconscious and wedged upside-down among the dolosse 20 feet below the top of the jetty. The 20-foot-plus waves almost dashed the rescuers off the jetty, too, as they pulled the man up and carried him the long way back

through the waves breaking over the jetty.

Hardesty, the Army Corps media man, says people aren't even supposed to go on the jetties.

"They were not intended for recreational use," he said. "There has been at least one death that I remember. And it's federal trespass. People can be cited; we have a memorandum of agreement with the Sheriff's Office there."

Conner says the Corps used to put up locked gates at the jetties, but people kept tearing them out and, besides, they deteriorated under the constant sea spray.

People want to go out on the jetties. And they do — to fish, amble and soak up the sun on nice days, and to listen to the rattling, booming bones of the dolosse on rough days. Yeah, they're kind of stupid. But there's no accounting for people's choice of thrills — whether it's teetering along the jetties or getting right down into that heaving entrance.

"One time," recalls Zerlang, "we crossed the bar in a 60-foot tug on a rough day, and we're all nervous and scared — and we look out our window and there's a bunch of guys on surfboards! I thought, 'What the hell's wrong with us? Those guys are out on a stick, and we're in a tugboat — and we're scared!'"

Or smart. ●

Saturday, April 9, 2016

COMMUNITY / ENVIRONMENT / NATURAL RESOURCES

# Orville Magoon, architect of Humboldt's jetties, dies at 87

POSTED BY THADEUS GREENSON  ON SAT, APR 9, 2016 AT 2:07 PM[click to enlarge](#)

SUBMITTED PHOTO

Orville Tyler Magoon

While his legacy in Humboldt County may live in for another century or more, Orville Tyler Magoon, the engineer who rebuilt the Humboldt jetties, has died. He was 87.

Magoon, who was featured in the *Journal's* Dec. 19, 2013 story "**Treacherous Maw,**" came up with the idea of reinforcing Humboldt's notoriously crumbly jetties with dolosse, massive, steel reinforced concrete forms modeled after a goat's ankle bone. The Army Corps of Engineers would go on to pile 6,000 of the 42-ton dolosse around the jetties' heads, which in 1977 drew the designation of being a historical civil engineering landmark. The jetties are still holding strong, 45 years after the dolosse were installed. And, in a 1994 interview with the *Times-Standard*, Magoon said that, with proper maintenance, the reinforced jetties should hold up much longer than 100 years.

*On March 19 in Santa Barbara, after a cruise to Hawaii, his beloved birthplace, Orville Tyler Magoon passed into history. He was surrounded by his wife and children. His life was one dedicated to our planet and its coastal treasures and to the people who surrounded him.*

*After his retirement from the Army Corps of Engineers in 1983 as a coastal engineer, he continued to dedicate his life to finding solutions to coastal issues, all the time managing the family estate winery in Lake and Napa counties, called Guenoc, and once owned by Lillie Langtry, British actress and legend. Guenoc and Langtry Estates vineyards and winery was producing over 100,000 cases of Lake County wine by 1999, on the property extending from Butts Canyon Road near Middletown across the line into Napa County. Magoon was a member of the Lake County Grape Growers Association, Les Amis du Vin, Supreme Grand Knight of the Brotherhood of the Knights of the Vine, the Order of Military Wine Tasters, and chairman of the Meritage Association. Magoon was affiliated with the Middletown Merchants Association, the Rotary Club of Middletown, and the Lake County Historical Society. Orville balanced his time between coastal engineering and managing the winery, which was producing award-winning wines, including the Genevieve Chardonnay named for Orville's mother and which was honored in *The Wine Spectator*.*

*In 2004 he retired from Guenoc to San Francisco with his wife, Karen. There he continued to work for better understanding of our beaches, with particular concern directed to sandmining and "Sand Rights," the importance of not interfering with the dynamics of sand movement to the detriment of coastal and beach stability. For his experience with and efforts to understand tsunamis, he was interviewed for the KQED broadcast, *Scary Tsunamis*.*

*Following his graduation from Punahou School class of 1946, Orville Magoon received his under graduate degree in Civil Engineering from the University of Hawaii in 1951 and an M.S. degree in Civil Engineering from Stanford University in 1952. After 30 years of experience in the field of coastal planning, design, construction and rehabilitation of coastal structures, Mr. Magoon retired as Chief of the Coastal Engineering Branch of the Planning Division of the US Army Corps of Engineers, South Pacific Division in July, 1983. He continued to be active in coastal zone management and coastal engineering through lectures at universities and symposia and his writing.*

*During his years of government service, Orville Magoon served on several committees and panels, including the Permanent International Association of Navigation Congresses (PIANC) Committee on Waves, on a number of National Aeronautics and Space Administration panels involved with remote sensing and satellite imagery of coastlines and the National Academy of Engineering.*

*Orville served as president of the Coastal Zone Foundation as well as vice chair of the Coastal Engineering Research Council for forty years and still had time to serve as President of the American Shore and Beach Preservation Association for ten years. In 1978 a series of Coastal Zone conferences was initiated by Orville, seeking solutions to coastal issues and held biannually, hosting up to 1,500 people. He continued to organize international, focused conferences on topics such as coastal structures, Coastlines of the World, Sand Rights, California and the World Ocean, Ocean Wave Measurement and Analysis resulting in over 60 of volumes of written proceedings.*

*Orville Magoon received several national and international awards during his career including the Jim Purpura National Coastal Engineering Award from FSBPA and the Murrough P. O'Brien Award from ASBPA. He also received the William Wisely, Arthur M. Wellington Prize, International Coastal Engineering Award and the Moffat-Nichol Awards from ASCE in recognition of his service to the coastal engineering and coastal zone management. His contributions to the profession were recognized with Distinguished Member of ASCE and Honorary Member of JSCE. Recognizing his devotion to students, Texas A&M University established the Orville T. Magoon Scholarship in 2003 which is given annually to one or more students who exhibit a strong interest in the field of coastal engineering and sustainability.*

*In recognition of his eminence in his profession, the American Society of Civil Engineers created the Orville T. Magoon Sustainable Coasts Award in 2014 which is given annually. This award is given to a leader who promotes the concept of sustainability in coastal engineering research, design, construction and management.*





Dolosse are nondescript reinforced concrete blocks that are scattered across coastlines all over the world. The blocks, which can weigh up to 88 tonnes, have an odd shape that allows them to interlock and when they are used in great numbers they protect breakwaters, groynes and harbours walls from the erosive force of the sea.

The first dolos was created in 1963 and it is a proudly South African invention. It was **initially called "the Merrifield block"**, according to Popular Mechanics, after one-time Port of East London System Harbour Engineer, **Eric Merrifield**. However, in later years Merrifield's claim has been superseded by Aubrey Kruger, who was a young draughtsman working at the port at the time.

Before dolosse were invented, **large rocks and concrete blocks** were the most common form of coastal protection in the east of the country, according to the Mercury. These massive blocks, however, could be easily washed away or displaced.

As the story goes, after a **storm in 1963 caused severe damage to the Eastern Cape's coastline**, Merrifield pondered if the breakwater would have been more resistant to the forces of nature if it was porous instead of bearing the full brunt of the force on one solid plane. The ideal protection was something that was cost-effective and would remain in place while dissipating the force of the waves.

This is where Kruger enters the picture. Depending on which account you believe, Merrifield then gave rise to the invention by discussing the design of a concrete structure with the young draughtsman or by **instructing him** to design it.

“The draughtsman, 28-year old Aubrey Kruger, was a modest, quiet local man who rode to work every day on a red Vespa scooter from his home in Cambridge, one of East London’s suburbs,” says the Mercury.

When Kruger went home for lunch on the day of the discussion, the first thing he apparently did was cut three pieces of wood from his wife Daphne’s broom.

He created a prototype by nailing the wood together in the shape of an ‘H’ with one twisted leg.

Both of Kruger’s children – his daughter Sandra, to the Mercury and his son Lance, to **DispatchLIVE** – say that their father based the design on the dubbeltjie thorn.

“He based it on the dubbeltjie thorn. Then he went back to work and put it on Mr Merrifield’s desk,” said Lance.



“He came into Merrifield and dad’s office and said: ‘Ek sien julle speel met dolosse’,” said Lance. “Dolosse were joint bones children used to play with and that’s how they were named.”

In the past, children used to play with these crude bone toys and pretend that they were a **team of oxen pulling a wagon**.

Dolosse were, in theory, meant to be placed in front of, and on top of, each other along the breakwater where they would eventually interlock as the waves crashed against them.

With time the structures would fit snugly but still allow some of the waves to pass through gaps, which would weaken their erosive powers.

The designs of the first dolos were completed in 1963 and were based on the shape of the wooden prototype made by Kruger. Merrifield, as port engineer, was responsible for managing the project and signing off all plans, according to the Mercury.

In 1964, the first dolos was laid on the port breakwater. Kruger and his family were very proud of the invention and when he was transferred to Durban in 1966 he was presented with a copy of the amendment to the design — dated July 12, 1966 — signed by Merrifield, as a parting gift.

While Kruger never formally received credit for the invention, Merrifield accepted the Shell Design Award and the Associated Science and Technology Societies of South Africa's Gold Medal, which hurt Kruger.

Sandra says that her father believed the invention to be the property of the South African Railways & Harbours (now Transnet), as it was developed on company time, which has been suggested as one of the reasons why the design of the dolos is not patent protected.

Kruger's contribution to the design was eventually recognised – shortly before his death in 2016 – when the South African Mint created a coin that commemorated the Dolos as part of its South African inventions theme.

The coins, a R2 crown and a 2½ cent 'tickey' displayed a series of dolosse and three miniature silver dolosse.

"The dolos was developed by East London harbour engineer Eric Mowbray Merrifield and draughtsman Aubrey Kruger, whose images are both included on the coin," **said Richard Stone**, the SA Mint product developer.

Kruger family was with him on the day the coins arrived from the Mint. His son Lance described it as an emotional occasion.

"We were all in the room when we gave him the coins and he got to touch them. He held them tight. We knew he was deteriorating and it was exciting to give this to him before he left us."

Picture/s: Wikimedia Commons

# SA world-famous dolos designer dies

By Barbara Hollands - 26 July 2016



## **References**

[Humboldt Bay](#)

[Humboldt Bay Jetty Dolos](#)

[Dolos - Wikipedia](#)

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