

Artemis Racing CEO describes scenarios in San Francisco Bay

By Mike McGreehan Correspondent San Jose Mercury News

Posted:

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ALAMEDA -- "Sailing," the 1980 Grammy Award-winning song by Christopher Cross, paints a picture of a peaceful activity on placid waters.

Sailing -- the America's Cup version -- often deals with the realities of stiff winds, choppy waters and high swells.

This year, the America's Cup comes to San Francisco Bay for the first time. Among the competitors is Artemis Racing, the Challenger of Record that represents the Royal Swedish Yacht Club and makes Alameda its home base in preparation for this summer's event.

On Feb. 28, Artemis Racing's Paul Cayard and Tom Schnackenberg addressed a packed house at the Alameda Theatre, apprising the public about the America's Cup, including possible scenarios that sailors might face.

For starters, this year's 34th America's Cup marks the debut of the state-of-the-art AC72 yachts, 72-foot catamarans with masts more than 130 feet tall.

"The wind will be blowing 20 to 30 knots this summer," said Cayard, Artemis Racing's CEO. "And one of the challenges is that we're not experienced multihull sailors."

Previous versions of the America's Cup involved monohulled boats sailing mostly on open seas near the host yacht club. San Francisco Bay offers unique challenges.

"It's a relatively small course and the wind is probably the strongest ever that we have experienced in July," said Schnackenberg, performance and design liaison for Artemis Racing. "Then there's the strength of the current. (The water) is relatively shallow here and it can get rough."

Sailing -- offering competition in various vessel classes -- has been long a part of the Summer Olympics since their 1896 inception. Given the attention paid to more "traditional" sports such as track and field, critics often pan sailors as "nonathletic."

But one look at the strapping men clad in Artemis Racing's red team shirts easily puts such stereotypes to rest.

"Another part of sailing that I like is the athletic aspect of it all," Cayard said. "These big catamarans require a high fitness level -- sometimes it's required just to save your life."

As such, sailors go through a rigorous training regimen, for during competitions heart rates can reach maximum levels and typically average 91 percent of maximum.

Surely, this type of training helped prepare the sailors of rival USA Team Oracle, whose catamaran capsized during a trial on the bay in October. Though Oracle's wing sail/mast was destroyed and much equipment was lost, the crew came through unscathed.

Bay Area environmental group proposes hybrid levees for bay

By Chris Palmer cpalmer@mercurynews.com San Jose Mercury News

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As global warming escalates, San Francisco Bay's existing flood protection system will be no match for rising sea levels. But according to a new report by a Bay Area environmental group, fortifying the bay's shoreline with levees fronted by restored tidal marshes will be a cheaper, more aesthetic and ecologically sensitive alternative to traditional levees.

The Bay Institute's report proposes restoring tidal marshes with sediment from local flood control channels and irrigating the marshes with treated wastewater. The plan also calls for "horizontal levees" that are a hybrid of traditional earthen levees and restored marshes.

Tidal marsh restoration in the bay has been a priority for environmental groups since the 1970s. More than 5,000 acres have been restored in the past two decades, with another 30,000 acres purchased and slated for restoration.

"Marshes act as the lungs of the bay," said John Bourgeois, manager of the South Bay Salt Pond Restoration Project. "They can clean and filter the water that comes down our tributaries before it hits the bay."

The tall, dense vegetation of tidal marshes can also absorb a significant amount of the energy of surging ocean waves during storms. "The concept is a good one. The physics of it are accurate," said Lisamarie Windham-Myers, a wetland ecologist at the U.S. Geological Survey. "It's been proven over and over that wetlands help reduce storm surges." Therefore, she said, levees don't have to be as tall.

The Bay Institute estimates that shorter levees fronted by tidal marshes would bring down the cost from more than \$12 million to less than \$7 million per mile, while providing the same level of flood protection. With 275 miles of bay shoreline to protect, total savings could eventually exceed more than a billion dollars.

"We knew the cost would be reduced, but we were shocked at the actual savings," said Marc Holmes, the Bay Institute's marsh restoration program director.

Funds to build and maintain levees have come over the years in piecemeal chunks from the federal government and local floodplain control agencies. The result has been a patchwork quilt of aging earthen levees, designed to protect against present-day sea levels.

The Bay Institute report was released about three weeks after U.S. Sens. Dianne Feinstein and Barbara Boxer reintroduced the San Francisco Bay Restoration Act, which seeks federal funding for wetland restoration and water improvement projects in the bay and its watershed.

"We hope we have now given them the ammunition to say, 'Look, this is not going to cost us money, it is going to save us money,'" Holmes said.

As carbon emissions cause the Earth to warm, polar ice melts and warmer ocean water expands. Already, sea levels in the bay rose 8 inches in the past century, leading to occasional flooding of major regional roadways such as state Highways 37 and 101 during winter storms.

According to a 2011 National Academy of Sciences report, sea levels off the California coast south of Cape Mendocino will rise another 1.5 inches to 11.8 inches by 2030, 4.7 inches to 24 inches by 2050 and 16.5 inches to 65 inches by the end of the century.

Even a moderate rise in sea level will likely lead to increases in flooding frequency and intensity. Developed areas particularly at risk are San Francisco and Oakland international airports and tech giants such as Oracle and Facebook.

Though rising sea levels are a concern, winter storms riding in on higher tides can cause the most havoc. "In the next

century, we're going to get more storms, fiercer storms," Holmes said. "Locations that were once outside of the danger zone are now inside, simply because storms are arriving on higher sea levels."

The goal of the Bay Institute study was to find a way to build a cost-effective network of levees that could lessen the flood threat caused by storm surges, while also providing benefits to the environment. The South Bay Salt Pond Restoration Project is considering a similar "horizontal levee" for its Alviso flood protection plan, which will be released later this year.

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The Bay Institute report imagines tidal marshes filled with silt to create a gentle upward slope from the bay shoreline to the top of a wedge-shaped earthen levee. Near the levee, tall, quick-growing plants with deep root systems would be irrigated with wastewater from nearby water treatment plants.

The sloping marsh can slow down storm surges, and the dense vegetation can absorb it like a sponge. Using marshes to buffer storm surges means earthen levees built on the landward side of the marshes can be built half as tall. As the vegetation grows taller and the root systems expand, the horizontal levee will be able to protect against the rise in sea levels expected in the coming decades, provided the restoration begins sooner rather than later.

Nearly 150,000 of the 190,000 acres of the bay's tidal marshes that existed in 1850 have been destroyed by conversion to uses such as salt evaporation ponds and agriculture.

Efforts to restore a few thousand acres of marshes that began in the late 1970s have now evolved into the largest marsh restoration plan in the country, with the goal of restoring 100,000 acres. The bay marshes are home to endangered species that exist nowhere else, as well as the largest estuary on the western coast of North and South America.

The Bay Institute report also recommends that Congress allocate \$1 billion to establish a program administered by the Environmental Protection Agency that would coordinate the various efforts to restore and protect the bay.

Congress has established a handful of comparable programs for nationally important regions such as the Great Lakes and Chesapeake Bay.

"Obviously," Holmes said, "we could make that case in San Francisco Bay persuasively."

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See Inside

California Megaflood: Lessons from a Forgotten Catastrophe

A 43-day storm that began in December 1861 put central and southern California underwater for up to six months, and it could happen again

By B. Lynn Ingram | Saturday, January 19, 2013 | 27 comments

Geologic evidence shows that truly massive floods, caused by rainfall alone, have occurred in California every 100 to 200 years. Such floods are likely caused by atmospheric rivers: narrow bands of water vapor about a mile above the ocean that extend for thousands of kilometers.

The atmospheric river storms featured in a January 2013 article in *Scientific American* that I co-wrote with Michael Dettinger, *The Coming Megafloods*, are responsible for most of the largest historical floods in many western states. The only megaflood to strike the American West in recent history occurred during the winter of 1861-62. California bore the brunt of the damage. This disaster turned enormous regions of the state into inland seas for months, and took thousands of human lives. The costs were devastating: one quarter of California's economy was destroyed, forcing the state into bankruptcy.

Today, the same regions that were submerged in 1861-62 are home to California's fastest-growing cities. Although this flood is all but forgotten, important lessons from this catastrophe can be learned. Much of the insight can be gleaned from harrowing accounts in diary entries, letters and newspaper articles, as well as the book *Up and Down California in 1860-1864*, written by William Brewer, who surveyed the new state's natural resources with state geologist Josiah Whitney.

In 1861, farmers and ranchers were praying for rain after two exceptionally dry decades. In December their prayers were answered with a vengeance, as a series of monstrous Pacific storms slammed—one after another—into the West coast of North America, from Mexico to Canada. The storms produced the most violent flooding residents had ever seen, before or since.

Sixty-six inches of rain fell in Los Angeles that year, more than four times the normal annual amount, causing rivers to surge over their banks, spreading muddy water for miles across the arid landscape. Large brown lakes formed on the normally dry plains between Los Angeles and the Pacific Ocean, even covering vast areas of the Mojave Desert. In and around Anaheim, , flooding of the Santa Ana River created an inland sea four feet deep, stretching up to four miles from the river and lasting four weeks.

Residents in northern California, where most of the state's 500,000 people lived, were contending with devastation and suffering of their own. In early December, the Sierra Nevada experienced a series of cold arctic storms that dumped 10 to 15 feet of snow, and these were soon followed by warm atmospheric rivers storms. The series of warm storms swelled the rivers in the Sierra Nevada range so that they became raging torrents, sweeping away entire communities and mining settlements in the foothills—California's famous "Gold Country." A January 15, 1862, report from the *Nelson Point Correspondence* described the scene: "On Friday last, we were visited by the most destructive and devastating flood that has ever been the lot of 'white' men to see in this part of the country. Feather River reached the height of 9 feet more than was ever known by the 'oldest inhabitant,' carrying away bridges, camps, stores, saloon, restaurant, and much real-estate." Drowning deaths occurred every day on the Feather, Yuba and American rivers. In one tragic account, an entire settlement of Chinese miners was drowned by floods on the Yuba River.

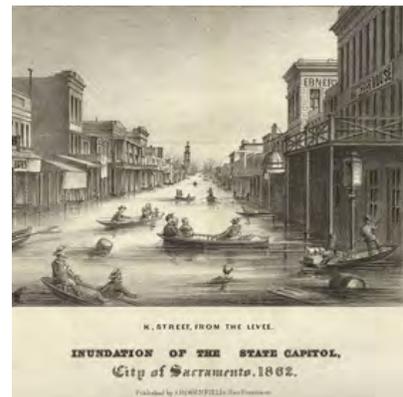


Image: USGS.gov

This enormous pulse of water from the rain flowed down the slopes and across the landscape, overwhelming streams and rivers, creating a huge inland sea in California's enormous Central Valley—a region at least 300 miles long and 20 miles wide. Water covered farmlands and towns, drowning people, horses and cattle, and washing away houses, buildings, barns, fences and bridges. The water reached depths up to 30 feet, completely submerging telegraph poles that had just been installed between San Francisco and New York, causing transportation and communications to completely break down over much of the state for a month. William Brewer wrote a series of letters to his brother on the east coast describing the surreal scenes of tragedy that he witnessed during his travels in the region that winter and spring. In a description dated January 31, 1862, Brewer wrote:

Thousands of farms are entirely under water—cattle starving and drowning. All the roads in the middle of the state are impassable; so all mails are cut off. The telegraph also does not work clear through. In the Sacramento Valley for some distance the tops of the poles are under water. The entire valley was a lake extending from the mountains on one side to the coast range hills on the other. Steamers ran back over the ranches fourteen miles from the river, carrying stock, etc, to the hills. Nearly every house and farm over this immense region is gone. America has never before seen such desolation by flood as this has been, and seldom has the Old World seen the like.

Brewer describes a great sheet of brown rippling water extending from the Coast Range to the Sierra Nevada. One-quarter of the state's estimated 800,000 cattle drowned in the flood, marking the beginning of the end of the cattle-based ranchero society in California. One-third of the state's property was destroyed, and one home in eight was destroyed completely or carried away by the floodwaters.

Sacramento, 100 miles up the Sacramento River from San Francisco, was (and still is) precariously located at the confluence of the Sacramento and American rivers. In 1861, the city was in many ways a hub: the young state's sparkling new capital, an important commercial and agricultural center, and the terminus for stagecoaches, wagon trains, the pony express and riverboats from San Francisco. Although floods in Sacramento were not unknown to the residents, nothing could have prepared them for the series of deluges and massive flooding that engulfed the city that winter. The levees built to protect Sacramento from catastrophic floods crumbled under the force of the rising waters of the American River. In early January the floodwaters submerged the entire city under 10 feet of brown, debris-laden water. The water was so deep and dirty that no one dared to move about the city except by boat. The floodwaters caused immense destruction of property and loss of life.

California's new Governor, Leland Stanford, was to be inaugurated on January 10, but the floodwaters swept through Sacramento that day, submerging the city. Citizens fled by any means possible, yet the inauguration ceremony took place at the capital building anyway, despite the mounting catastrophe. Governor Stanford was forced to travel from his mansion to the capital building by rowboat. Following the expedited ceremony, with floodwaters rising at a rate of one foot per hour, Stanford rowed back to his mansion, where he was forced to steer his boat to a second story window in order to enter his home. Conditions did not improve in the following weeks. California's legislature, unable to function in the submerged city, finally gave up and moved to San Francisco on January 22, to wait out the floods.

Sacramento remained underwater for months. Brewer visited the city on March 9, three months after the flooding began, and described the scene:

Such a desolate scene I hope to never see again. Most of the city is still under water, and has been there for three months. A part is out of the water, that is, the streets are above water, but every low place is full—cellars and yards are full, houses and walls wet, everything uncomfortable. No description that I can write will give you any adequate conception of the discomfort and wretchedness this must give rise to. I took a boat and two boys, and we rowed about for an hour or two. Houses, stores, stables, everything, were surrounded by water. Yards were ponds enclosed by dilapidated, muddy, slimy fences; household furniture, chairs, tables, sofas, the fragments of houses, were floating in the muddy waters or lodged in nooks and corners. I saw three sofas floating in different yards. The basements of the better class of houses were half full of water, and through the windows, one could see chairs, tables, bedsteads, etc., afloat. Through the windows of a schoolhouse I saw the benches and desks afloat. Over most of the city boats are still the only way of getting around.

The new Capital is far out in the water—the Governor's house stands as in a lake—churches, public buildings, private buildings, everything, are wet or in the water. Not a road leading from the city is passable, business is at a dead standstill, everything looks forlorn and wretched. Many houses have partially toppled over; some have been carried from their foundations, several streets (now avenues of water) are blocked up with houses that have floated in them, dead animals lie about here and there—a dreadful picture. I don't think the city will ever rise from the shock, I don't see how it can.

The death and destruction of this flood caused such trauma that the city of Sacramento embarked on a long-term project of raising the downtown district by 10 to 15 feet in the seven years after the flood. Governor Stanford also raised his mansion from two to three stories, leaving empty the ground floor, to avoid damage from any future flooding events.

Downstream of Sacramento, towns and villages throughout the eastern San Francisco Bay Area were struggling with catastrophes of their own. Twenty miles northeast of San Francisco, four feet of water covered the entire town of Napa; to the east, the small town of Rio Vista on the Sacramento River was under six feet of water. The entire population of Alamo, at the foot of Mt. Diablo 50 miles east of San Francisco, was forced to flee rising floodwaters. People abandoned their homes in the middle of the night. Some found refuge, others drowned. The San Ramon Valley was one sheet of water from hill to hill as far as the eye could see. The destructive force of the floods was awesome: houses, otherwise intact and complete with their contents, were carried away in the rapids; horses, cattle, and barns were swept downstream for miles.

The heavy rains also triggered landslides and mud slides on California's steep hillsides. For instance, in Knights Ferry and Mokelumne Hill, nearly every building was torn from its foundation and carried off by thundering landslides, and a major landslide also occurred at the town of Volcano in the Sierra foothills, killing seven people.

The 1861-62 floods extended far beyond the borders of California. They were the worst in recorded history over much of the American West, including northern Mexico, Oregon, Washington State and into British Columbia, as well as reaching inland into Nevada, Utah and Arizona. In Nevada, a normally arid state, twice its typical annual rainfall occurred in the two-month period of December 1861 to January 1862. All this excess water transformed the Carson Valley into a large lake, inundating Nevada City with nine feet of rain in 60 days.

In southern Utah, 1861-62 became known as the "year of the floods," as homes, barns, a fiber and molasses mill and many forts were washed away, including the adobe home of a Mormon Bishop, John D. Lee. Lee had carefully recorded the weather throughout January 1862 in his diary, noting a solid period of alternating rain and snow with strong winds for most of that month. In Oregon, two and a half weeks of solid rain caused the worst flooding in this state's history. Deluges covered huge portions of the lower Willamette Valley where Oregon City is located. Oregon City was the terminus of the Oregon Trail, and it was the state's capital, where George Abernathy, an Oregon pioneer and the state's first elected governor, lived and ran a thriving business. The flood destroyed his home, forcing him (and many others) to leave. Arizona was also impacted: floods occurred in the Gila, Verde, Bright Angel and Colorado River basins between January 19 and 23, 1862, and flooding was severe in Yuma, destroying the city.

Why so many people were caught off-guard by these floods remains a mystery, but clearly these immigrants did not recognize the climatic warning signs. They had never experienced such extreme flooding in the 12 years since the Gold Rush began, although lesser floods were not uncommon. It appears that the Native American populations, who had lived in the region for thousands of years, had deeper insights to the weather and hydrology, and recognized the patterns that result in devastating floods. A piece in the *Nevada City Democrat* described the Native American response on January 11, 1862:

We are informed that the Indians living in the vicinity of Marysville left their abodes a week or more ago for the foothills predicting an unprecedented overflow. They told the whites that the water would be higher than it has been for thirty years, and pointed high up on the trees and houses where it would come. The valley Indians have traditions that the water occasionally rises 15 or 20 feet higher than it has been at any time since the country was settled by whites, and as they live in the open air and watch closely all the weather indications, it is not improbable that they may have better means than the whites of anticipating a great storm.

The specific weather pattern that the Native Americans of the West recognized and knew would bring particularly severe flooding is once again understood today. The powerful storms originate in the warm and moist tropical Pacific Ocean. Recent research describes these storms more broadly as "atmospheric rivers," and they often result in the worst floods in not only the American West, but across the globe.

The tragic 1861-62 floods may have temporarily served to wake-up the residents of California and the West to the possible perils of their region's weather. They saw nature at its most unpredictable and terrifying, turning in a day or an hour from benign to utterly destructive. But the costs to the state went beyond the loss of life, property and resources: California's spirit and confidence was badly shaken.

The lessons of the 1861–62 floods should provide the impetus for flood disaster planning efforts in a region where housing developments and cities are spreading across many floodplains. A critical element of living in a place like California is an awareness of these natural disasters, which requires a deep understanding of the natural patterns and frequencies of these events. Today we have building codes for earthquake safety, but millions of new westerners are not aware of the region's calamitous climate history. Most have never even heard of the 1861–62 floods, and those may not have been the worst that nature can regularly dish out to the region. In a forthcoming book I co-wrote with Frances Malamud-Roam, *THE WEST WITHOUT WATER: What Past Floods, Droughts, and Other Climatic Clues Tell Us About Tomorrow* (University of California Press, Spring 2013) we present evidence for similar if not larger floods that have occurred every one to two centuries over the past two millennia in California, as well as nature's flip-side: deep and prolonged droughts.

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New Observatories Will Warn Public about "Atmospheric River" Floods

An \$11-million weather sensor network being installed in California will give officials more time to prepare for onslaughts of Pacific storms

By Mark Fischetti | Tuesday, December 4, 2012 | 15 comments

SAN FRANCISCO—The heavy rainstorms that flooded parts of northern California this past week were caused by an "atmospheric river"—a long, narrow conveyor belt of rainstorms that stream in from the Pacific Ocean. Meteorologists were able to predict the storms five days in advance, thanks to a new network of weather sensors recently installed in the state. Although the network is only partially complete, when it is finished in 2014 it should allow forecasters to predict upcoming storms and floods with much greater precision, and could provide a model warning system for flooding on continental west coasts worldwide.

An atmospheric river flows about a 1.5 kilometers above the ocean surface and can extend thousands of miles out to sea, carrying as much water as 15 Mississippi Rivers. It strikes a coast as a series of storms that arrive for days or weeks on end. Each storm can dump centimeters of rain or meters of snow. Meteorologists have had some difficulty predicting the amounts of precipitation, and therefore possible flooding. Satellite radars can track airborne water vapor well over the ocean but not so well over land, according to Martin Ralph, a research meteorologist with the National Atmospheric and Oceanic Administration (NOAA) Earth System Research Laboratory in Boulder, Colo., speaking at the annual American Geophysical Union conference here. Satellites also do not give a good assessment of winds within the corridor of water vapor, which affects how quickly they move rain inland.

Furthermore, the amount of flooding is strongly influenced by how wet or dry a region's soil is before and during the storms, which can only be accurately measured by sensors embedded in the ground. Knowing how much of the precipitation will fall as rain or snow is also important, because rain causes more immediate flooding whereas snow may cause delayed flooding.

The new warning system will provide all that information and more. Snow radars are being deployed in 10 major watersheds. Soil moisture sensors are being installed at 43 sites across California, which will be key to anticipating whether an incoming storm will produce heavy runoff, according to Michael Dettinger, a research hydrologist at the Scripps Institution of Oceanography in La Jolla, Calif., who was also speaking at the meeting. (Dettinger is co-author of a detailed article about atmospheric rivers in the January issue of *Scientific American*). Some of the snow radars and about three quarters of the soil sensors are already in place.

The centerpiece of the system will be four unique "atmospheric river observatories" located about 400 kilometers from one another. The units, about the size of a dump truck, look upward and show precise wind speed and direction at several altitudes, the elevation at which precipitation is rain or snow, and the total amount of water vapor above the site. They also indicate standard weather data such as temperature, humidity and atmospheric pressure. The first observatory is being installed right now in Bodega Bay. The others will be set up in Eureka, Point Sur and Goleta.

The partially completed system already proved its worth two weeks ago. When satellite imagery showed moisture accumulating over the central Pacific researchers drove a mobile observatory into northern California and began compiling data from it with the other sensors that were already operating. Forecasters were able to predict five days in advance that an atmospheric river would begin pummeling the state. True to the forecast, storms started hitting the coast on November 28 and lasted five days, dumping up to 38 centimeters of rain,



A mobile atmospheric river observatory
Image: Courtesy of NOAA

causing flooding and mud slides. Forecasters used the information to warn residents which rivers might flood when, and the state's Department of Water Resources used it to help decide whether to try to mitigate flooding by opening or closing dams and other structures along California's rivers.

NOAA has posted data from the initial tests online. When the system is complete the data it generates will be available to the public online, in real time. And the system could provide a model for better prediction around the world. Atmospheric rivers can strike the west coasts of most continents and landmasses; in mid-November a series of atmospheric-river storms caused the heaviest flooding in western England and Wales since the 1960s.

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The New York Times

March 4, 2013

Long Stuck in Obscurity, Bay Bridge Will Go From Drab Gray to Glowing

By MALIA WOLLAN

SAN FRANCISCO — For decades the San Francisco-Oakland Bay Bridge has been considered, when it is considered at all, as a headache for commuters and a place not to be in an earthquake.

But that reputation is set to change Tuesday night when the artist Leo Villareal will switch on what is being billed as the world's largest L.E.D. light sculpture. The public art installation, "The Bay Lights," will illuminate the bridge's 1.8-mile western span with 25,000 undulating white lights.

"My inspiration comes from the motion around the bridge, the kinetic activity of boats, water, clouds, traffic," Mr. Villareal said.

From a distance, it will appear as a shimmering illuminated mass, but Mr. Villareal controls each light individually with a software program he developed. He turns the whole thing on and off from his laptop.

Mr. Villareal's ability to fuse technology into his art is particularly apt here in a city awash in new tech wealth and buzzing with the frenetic energy of start-ups and highly caffeinated computer programmers.

The light sculpture, which will be on every night for two years, has become a darling of moneyed Silicon Valley types. The project is privately financed and is estimated to cost some \$8 million.

Already restaurants with bridge views are booked and boat cruise operators are creating new tours for viewing the glowing infrastructure. Organizers estimate the lights will bring in \$97 million to the local economy.

The unlikely star of all this fawning attention is the unassuming Bay Bridge.

When it opened to traffic Nov. 12, 1936, the city celebrated with five days of parades, a Navy air show and a regatta.

But just five months later, the Golden Gate Bridge followed with its flashier, red-painted steel

spanning the more picturesque mouth of the bay. It quickly became an international tourist destination, while the Bay Bridge toiled along in utilitarian, gray obscurity. Last year some 40 million cars crossed the Golden Gate Bridge, while the Bay Bridge carried more than 100 million cars.

“These bridges really came up as twin sisters, one quite beautiful and one very hard working,” said Ben Davis, who originally approached Mr. Villareal about adorning the bridge in lights. As founder of the agency responsible for branding on the newly constructed, \$6.4 billion eastern span of the Bay Bridge, Mr. Davis has spent years thinking about the bridge’s legacy. “This project will elevate the Bay Bridge, at least for a while, above the Golden Gate Bridge,” he said.

When both bridges recently celebrated their 75th anniversaries, San Francisco showered the Golden Gate Bridge in an elaborate fireworks show while the Bay Bridge’s birthday went by seemingly unnoticed. The Bay Bridge has also suffered other, graver, setbacks along the way.

In the 1989 [Loma Prieta earthquake](#), a section of the bridge’s eastern span collapsed, killing a driver and closing the bridge for a month. Since then the bridge has undergone a series of seismic retrofits, including the new eastern span scheduled to open later this year.

While the sheer size of “The Bay Lights” installation is a first for San Francisco, in recent years many cities across the world have hosted contemporary public art projects writ large, sometimes very large.

The artist Olafur Eliasson’s “The Waterfalls,” went up in New York in 2008 and featured four man-made waterfalls, some as tall as 120 feet (cost: \$15 million). In 2005, Christo and Jeanne-Claude’s “The Gates,” had Central Park draped in one million square feet of saffron-colored fabric (cost: \$21 million).

Nicholas Baume, director of the Public Art Fund, a New York based nonprofit organization, said of “The Bay Lights,” “What this project confirms for me is the wide recognition that when you invite artists to participate in creating works for all kinds of urban public places, it adds tremendous vitality to those cities.”

Mr. Villareal, 46, is best known for large-scale light sculptures that are in the permanent collections of the Museum of Modern Art in New York and the National Gallery of Art in Washington. Though he now lives in New York City, Mr. Villareal started his career in Silicon Valley. In the 1990s, he worked at the Interval Research Corporation, a technology company in Palo Alto, Calif., started by Paul Allen, co-founder of Microsoft. Mr. Villareal designed his first light sculpture in 1997 for [Burning Man](#), an arts festival in the Nevada desert.

The tech industry has given generously to the project despite a reputation for being closefisted when it comes to philanthropy.

Marissa Mayer, chief executive at Yahoo, is among the project's patrons. Ron Conway, one of Silicon Valley's most prolific investors, described the bridge in its natural state as "bland," so he donated some \$50,000. Paul Buchheit, an early Google employee who created the first version of Gmail gave about \$250,000.

For Mark Pincus, chief executive of Zynga, maker of online games like Farmville, and his wife, Alison, donating money and organizing fund-raisers also offered a private perk; they can see the light sculpture from their San Francisco home.

Some arts groups are encouraged by Silicon Valley's support for the project. "I'm hopeful that this is a sign that all the wealth in the tech sector will mean a new wave of investment in public art," said Tom DeCaigny, director of cultural affairs for the San Francisco Arts Commission.

And while patrons prepare for celebratory cocktail parties with prime bridge views, the lights will also be visible, for free.

"The great thing about public arts is it does not cost anything to see," Mr. Baume said. "There are no tickets for admission, it is there for everybody."

Recent heat spike unlike anything in 11,000 years

By SETH BORENSTEIN, AP Science Writer
Updated 7:17 am, Friday, March 8, 2013

WASHINGTON (AP) — A new study looking at 11,000 years of climate temperatures shows the world in the middle of a dramatic U-turn, lurching from near-record cooling to a heat spike.

Research released Thursday in the journal *Science* uses fossils of tiny marine organisms to reconstruct global temperatures back to the end of the last ice age. It shows how the globe for several thousands of years was cooling until an unprecedented reversal in the 20th century.

Scientists say it is further evidence that modern-day global warming isn't natural, but the result of rising carbon dioxide emissions that have rapidly grown since the Industrial Revolution began roughly 250 years ago.

The decade of 1900 to 1910 was one of the coolest in the past 11,300 years — cooler than 95 percent of the other years, the marine fossil data suggest. Yet 100 years later, the decade of 2000 to 2010 was one of the warmest, said study lead author Shaun Marcott of Oregon State University. Global thermometer records only go back to 1880, and those show the last decade was the hottest for this more recent time period.

"In 100 years, we've gone from the cold end of the spectrum to the warm end of the spectrum," Marcott said. "We've never seen something this rapid. Even in the ice age the global temperature never changed this quickly."

Using fossils from all over the world, Marcott presents the longest continuous record of Earth's average temperature. One of his co-authors last year used the same method to look even farther back. This study fills in the crucial post-ice age time during early human civilization.

Marcott's data indicates that it took 4,000 years for the world to warm about 1.25 degrees from the end of the ice age to about 7,000 years ago. The same fossil-based data suggest a similar level of warming occurring in just one generation: from the 1920s to the 1940s. Actual thermometer records don't show the rise from the 1920s to the 1940s was quite that big and Marcott said for such recent time periods it is better to use actual thermometer readings than his proxies.

Before this study, continuous temperature record reconstruction only went back about 2,000 years. The temperature trend produces a line shaped like a "hockey stick" with a sudden spike after what had been a fairly steady line. That data came from tree rings, ice cores and lake sediments.

Marcott wanted to go farther back, to the end of the last ice age in more detail by using the same marine fossil method his colleague used. That period also coincides with a "really important time for the history of our planet," said Smithsonian Institution research anthropologist Torben Rick. That's the time when people started to first domesticate animals and start agriculture, which is connected to the end of the ice age.

Marcott's research finds the climate had been gently warming out of the ice age with a slow cooling that started about 6,000 years ago.

Then the cooling reversed with a vengeance.

The study shows the recent heat spike "has no precedent as far back as we can go with any confidence, 11,000 years arguably," said Pennsylvania State University professor Michael Mann, who wrote the original hockey stick study but wasn't part of this research. He said scientists may have to go back 125,000 years to find warmer temperatures potentially rivaling today's.

However, another outside scientist, Jeff Severinghaus of the Scripps Institution of Oceanography thinks temperatures may have been notably warmer just 12,000 years ago, at least in Greenland based on research by some of his colleagues.

Several outside scientists praised the methods Marcott used, but said it might be a bit too oriented toward the Northern Hemisphere.

Marcott said the general downward trend of temperatures that reversed 100 years ago seemed to indicate the Earth was heading either toward another ice age or little ice age from about 1550 to 1850. Or it was continuing to cool naturally until greenhouse gases from the burning of fossil fuels changed everything.

The reason the globe warmed after the ice age and then started cooling about 6,000 years ago has to do with the tilt of the Earth and its distance from the sun, said Marcott and Severinghaus. Distance and angle in the summer matter because of heat absorption and reflection and ground cover.

"We have, through human emissions of carbon dioxide and other heat-trapping gases, indefinitely delayed the onset of the next ice age and are now heading into an unknown future where humans control the thermostat of the planet," said Katharine Hayhoe, an atmospheric scientist at Texas Tech University, responding in an email.

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HEARST *newspapers*

Herring harvest: Inside the last commercial fishery in San Francisco Bay

By Denis Cuff *Contra Costa Times San Jose Mercury News*

Posted:

MercuryNews.com

SAN FRANCISCO BAY -- Dennis Deaver was doing his taxes late at night at home in Alamo when he got an urgent call. It was time to hunt in San Francisco Bay.

The herring were running.

A school of the silvery fish had followed the tide in and were slathering millions of their tiny golden eggs in shallow waters near Tiburon. In days, maybe even hours, the fish would disappear back into the ocean.

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After years of decline that ended in the first cancellation of the season three years ago, the herring catch is having a third straight strong year, fishers and biologists say.

"The herring are coming back after a long-term erosion," Deaver, a veteran fisherman, said as he pulled into San Francisco's Pier 45 after a night of fishing -- his gill-net boat weighed down by 17 1/2 tons of the fish.

"The upswing is good for us. It's good for salmon, other fish, pelicans, seal lions and lots of things that feed on the herring," Deaver said.

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Elsewhere around the bay, those who spend time by the shore have noticed the seabird feeding frenzy. Herring spawn in the bay four to 10 times a year from December to March on rocks, vegetation or docks near the shore from the Golden Gate to the East Bay, North Bay and South Bay. The fishing season lasts from Jan. 2 to March 15.

Dan Seifers, a Richmond shoreline resident and charter boat owner, knew the herring were spawning nearby when he saw the birds gather off Miller Knox Regional Shoreline near his home.

"You see this sudden explosion in the number of seabirds in an area," he said. "Then we see the birders who want to see the spectacle."

A state biologist said the future is promising for herring, which were hurt by several dry years, the 2007 Cosco Busan oil spill, poor food conditions in the ocean and occasional El Niño ocean-warming currents.

"It's looking good," said Ryan Bartling, a marine fisheries scientist with the state Department of Fish and Wildlife. "We expect this upward swing to continue," although there may be variation from year to year, he said.

The bay's peak herring season was 1996-97 when 12,326 tons were netted.

From 145 to 754 tons of herring were caught in the bay each year between the 2004-05 and 2008-09 seasons; none were caught during the season closure of 2009-10.

More than 1,600 tons were landed in each of the past two seasons. This year, it's nearly 2,400 tons -- 83 percent of the state-set quota, California officials said.

The prospects were good enough this year that Kevin Marilley trucked his boat in from Bellingham, Wash., to fish bay herring for the first time since 2007.

"It wasn't worth the cost before to come here," he said from aboard his boat.

In Sausalito, fans held a February herring festival to promote the fish as a local, sustainable food.

But while many bay birds and beasts crave herring, most of the 7 million people who live around the bay don't seem to care for them or their eggs.

It is far different in Japan, where the golden-colored roe harvested from the fish is a delicacy, especially among the older generation.

Japanese demand has softened in the past 15 years, though, cutting the prices paid.

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The bay herring fleet has averaged \$5.5 million per year since 1985.

With prices down, the bay's herring fleet that once numbered more than 200 boats is down to about 35 -- most of the fishermen are graying, experienced veterans like Deaver.

Deaver, 62, began commercial fishing in his teens and started to pursue herring as a deckhand in the 1970s when the industry was just getting off the ground.

He later branched out to more dangerous but profitable crab and salmon fishing in Alaska, and he still owns boats in that industry.

In the late 1800s, the bay and the Delta were the foremost fishing center on the West Coast. Fishers caught salmon, shad, striped bass and sturgeon. At their peak in 1882, 19 canneries on the Delta canned 200,000 cases of salmon.

Bay oysters were also harvested, luring oyster pirates like a young Jack London, who later wrote about the experience.

But environmental damage caused by overfishing, development, pollution and non-native species took a heavy toll. Over time, other commercial fishing faded away or was banned inside the bay. Only the herring fishers remain.

"We are kind of like the buffalo hunters, but there's no reason not to keep fishing if the resource is there and properly managed," Deaver said. "I like the challenge of finding the fish. And if the fish aren't there, you can take in the boat and come back another day."

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Artemis Racing CEO describes scenarios in San Francisco Bay

By Mike McGreehan Correspondent San Jose Mercury News

Posted:

MercuryNews.com

ALAMEDA -- "Sailing," the 1980 Grammy Award-winning song by Christopher Cross, paints a picture of a peaceful activity on placid waters.

Sailing -- the America's Cup version -- often deals with the realities of stiff winds, choppy waters and high swells.

This year, the America's Cup comes to San Francisco Bay for the first time. Among the competitors is Artemis Racing, the Challenger of Record that represents the Royal Swedish Yacht Club and makes Alameda its home base in preparation for this summer's event.

On Feb. 28, Artemis Racing's Paul Cayard and Tom Schnackenberg addressed a packed house at the Alameda Theatre, apprising the public about the America's Cup, including possible scenarios that sailors might face.

For starters, this year's 34th America's Cup marks the debut of the state-of-the-art AC72 yachts, 72-foot catamarans with masts more than 130 feet tall.

"The wind will be blowing 20 to 30 knots this summer," said Cayard, Artemis Racing's CEO. "And one of the challenges is that we're not experienced multihull sailors."

Previous versions of the America's Cup involved monohulled boats sailing mostly on open seas near the host yacht club. San Francisco Bay offers unique challenges.

"It's a relatively small course and the wind is probably the strongest ever that we have experienced in July," said Schnackenberg, performance and design liaison for Artemis Racing. "Then there's the strength of the current. (The water) is relatively shallow here and it can get rough."

Sailing -- offering competition in various vessel classes -- has been long a part of the Summer Olympics since their 1896 inception. Given the attention paid to more "traditional" sports such as track and field, critics often pan sailors as "nonathletic."

But one look at the strapping men clad in Artemis Racing's red team shirts easily puts such stereotypes to rest.

"Another part of sailing that I like is the athletic aspect of it all," Cayard said. "These big catamarans require a high fitness level -- sometimes it's required just to save your life."

As such, sailors go through a rigorous training regimen, for during competitions heart rates can reach maximum levels and typically average 91 percent of maximum.

Surely, this type of training helped prepare the sailors of rival USA Team Oracle, whose catamaran capsized during a trial on the bay in October. Though Oracle's wing sail/mast was destroyed and much equipment was lost, the crew came through unscathed.

Silver age of cruising ahead for San Francisco?

By Anne Chalfant San Jose Mercury News Correspondent San Jose Mercury News

Posted:

MercuryNews.com

Picture three big, white, handsome cruise ships lined up along San Francisco's Embarcadero.

While you're at it, visualize yourself striding up a gangplank, a happy seagoer in the Bay Area cruise craze.

Now hold that thought. San Francisco is not yet a departure port for cruises in the way that, say, Seattle is.

But that could change with the maritime welcome mat laid out in late February. The opening of San Francisco's new James R. Herman Cruise Terminal promises a classy welcome to cruise passengers and issues an invitation to the cruise industry's new megaships, which this terminal can accommodate.

Just how big? Some behemoths built in recent years are up to 1,200 feet long -- that's almost four football fields -- and can carry 5,000 to 6,000 passengers. Most ships, however, will carry only half that many.

What also has changed is the greeting that awaits visitors. After sailing under the iconic Golden Gate Bridge, passengers will stroll down the gangplank into the new terminal, where floor-to-ceiling windows serve up a live, panoramic postcard of one of the world's most beautiful cities, complete with Coit Tower, Telegraph Hill and the Transamerica Pyramid.

But cruise passengers will have to save their ooohs and aahs for early 2014, when the terminal interior at Pier 27 is completed (in the meantime, ships will continue to use the terminal at Pier 35). For the next eight months, the new terminal's 60,000 square-foot empty space is in the hands of its first occupant, America's Cup, which is also the economic force that kick-started the terminal's construction.

This summer, the bay will brighten with speeding sails of the world's fastest ships, 72-foot wing-sail catamarans. America's Cup Park -- akin to an Olympic Village for sailing teams, race officials and media -- will liven the new cruise terminal and several adjacent piers. The races kick off July 4 to Sept. 1 with the Louis Vuitton Cup. The 34th America's Cup finals are Sept. 7-22.

America's Cup organizers pledged as much as \$100 million to the city of San Francisco for port and harbor improvements, and the James R. Herman terminal, with its \$90 million price tag, got a chunk of that. A 2.5-acre waterfront park, Northeast Wharf Plaza, will be built beside the new terminal, adding waterfront recreation space and a good spot to gawk at a docked cruise ship.

The contract with America's Cup pushed decades of discussion to an action plan, said Peter Dailey, deputy director of maritime for the Port of San Francisco. With the new terminal's capability of accommodating the largest of ships, "We'll stay in step with the industry for the next 50 years," he said.

Bring it, cruise lines

One more thing the James R. Herman Cruise Terminal will accomplish -- actualizing the dream of the former port commissioner for whom the terminal is named. During his lifetime, Herman was a vocal proponent, urging the city to honor its maritime roots and again make San Francisco one of the world's great ports.

Building a new terminal is the first step. The next is to persuade cruise lines that starting a voyage in San Francisco -- not just stopping here -- is a good plan. More departures from home port would be a boon for Bay Area travelers. Monique Moyer, the port's executive director, said cruise lines have been checking in to discuss possibilities.

A major obstacle to San Francisco's becoming a major cruise embarkation port is geography -- the Pacific Ocean doesn't offer numerous destinations in the way the Caribbean does. And unlike East Coast ports -- a week's sail away from Europe -- San Francisco to Asia is a long haul.

Itineraries that currently make port calls in San Francisco follow routes to Alaska; the California Coast; Baja, Mexico; the Pacific Northwest; Victoria and Vancouver, British Columbia; Hawaii; plus a few to Tahiti. Those itineraries, plus a few world cruises and Panama Canal cruises, account for the 66 cruise ships making calls in San Francisco in 2013.

On the plus side, it might not be hard to persuade cruise lines to consider San Francisco as a departure port. The Bay Area is a sophisticated travel region and also home to retiring baby boomers with money to spend. South American itineraries might be popular here, given the elimination of the cost and time of flying to Miami.

Call it home

One company embracing San Francisco's maritime makeover is Princess, which is relocating its Grand Princess here from Fort Lauderdale, Fla. The ship, which arrives here March 16, is a gem. When it was introduced in 1998, it was the largest ship at sea, with 700 balconied cabins, back when 951 feet was really something. Thanks to a multimillion-dollar makeover in 2011, it is now outfitted with more dining and entertainment options, including movies shown poolside, Leaves Tea Lounge and Library, and One5, a late-night nightclub.

Home port status does not mean that Grand Princess will be hanging around. Typically, it will only be in port a short day between voyages, arriving at 7 a.m. to offload passengers, then loading a new set and embarking on its next sail at 4 p.m. Itineraries include Alaska; California Coastal; Wine Country Coastal; and a cruise to Hawaii, Tahiti and the South Pacific.

Like all cruise ships arriving this year, Grand Princess will be ushered into Terminal 35, the old terminal. The terminal, built in 1914, is bleak -- a windowless, unheated steel building that has all the charm of an empty aircraft hangar. Still, Pier 35 has history that dates back to the golden age of cruising, when around-the-world journeys were fashionable for the wealthy.

And it won't be scrapped anytime soon. When more than one ship visits San Francisco at the same time, that extra terminal will come in handy.

Anne Chalfant is a former travel editor for Bay Area News Group and author of the app "Cruise! A Guide for Ships and Trips."

Herring harvest: Inside the last commercial fishery in San Francisco Bay

By Denis Cuff *Contra Costa Times San Jose Mercury News*

Posted:

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After years of decline that ended in the first cancellation of the season three years ago, the herring catch is having a third straight strong year, fishers and biologists say.

"The herring are coming back after a long-term erosion," Deaver, a veteran fisherman, said as he pulled into San Francisco's Pier 45 after a night of fishing -- his gill-net boat weighed down by 17 1/2 tons of the fish.

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The New York Times

March 4, 2013

Long Stuck in Obscurity, Bay Bridge Will Go From Drab Gray to Glowing

By MALIA WOLLAN

SAN FRANCISCO — For decades the San Francisco-Oakland Bay Bridge has been considered, when it is considered at all, as a headache for commuters and a place not to be in an earthquake.

But that reputation is set to change Tuesday night when the artist Leo Villareal will switch on what is being billed as the world's largest L.E.D. light sculpture. The public art installation, "The Bay Lights," will illuminate the bridge's 1.8-mile western span with 25,000 undulating white lights.

"My inspiration comes from the motion around the bridge, the kinetic activity of boats, water, clouds, traffic," Mr. Villareal said.

From a distance, it will appear as a shimmering illuminated mass, but Mr. Villareal controls each light individually with a software program he developed. He turns the whole thing on and off from his laptop.

Mr. Villareal's ability to fuse technology into his art is particularly apt here in a city awash in new tech wealth and buzzing with the frenetic energy of start-ups and highly caffeinated computer programmers.

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Already restaurants with bridge views are booked and boat cruise operators are creating new tours for viewing the glowing infrastructure. Organizers estimate the lights will bring in \$97 million to the local economy.

The unlikely star of all this fawning attention is the unassuming Bay Bridge.

When it opened to traffic Nov. 12, 1936, the city celebrated with five days of parades, a Navy air show and a regatta.

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spanning the more picturesque mouth of the bay. It quickly became an international tourist destination, while the Bay Bridge toiled along in utilitarian, gray obscurity. Last year some 40 million cars crossed the Golden Gate Bridge, while the Bay Bridge carried more than 100 million cars.

“These bridges really came up as twin sisters, one quite beautiful and one very hard working,” said Ben Davis, who originally approached Mr. Villareal about adorning the bridge in lights. As founder of the agency responsible for branding on the newly constructed, \$6.4 billion eastern span of the Bay Bridge, Mr. Davis has spent years thinking about the bridge’s legacy. “This project will elevate the Bay Bridge, at least for a while, above the Golden Gate Bridge,” he said.

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Some arts groups are encouraged by Silicon Valley's support for the project. "I'm hopeful that this is a sign that all the wealth in the tech sector will mean a new wave of investment in public art," said Tom DeCaigny, director of cultural affairs for the San Francisco Arts Commission.

And while patrons prepare for celebratory cocktail parties with prime bridge views, the lights will also be visible, for free.

"The great thing about public arts is it does not cost anything to see," Mr. Baume said. "There are no tickets for admission, it is there for everybody."

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New Observatories Will Warn Public about "Atmospheric River" Floods

An \$11-million weather sensor network being installed in California will give officials more time to prepare for onslaughts of Pacific storms

By Mark Fischetti | Tuesday, December 4, 2012 | 15 comments

SAN FRANCISCO—The heavy rainstorms that flooded parts of northern California this past week were caused by an "atmospheric river"—a long, narrow conveyor belt of rainstorms that stream in from the Pacific Ocean. Meteorologists were able to predict the storms five days in advance, thanks to a new network of weather sensors recently installed in the state. Although the network is only partially complete, when it is finished in 2014 it should allow forecasters to predict upcoming storms and floods with much greater precision, and could provide a model warning system for flooding on continental west coasts worldwide.

An atmospheric river flows about a 1.5 kilometers above the ocean surface and can extend thousands of miles out to sea, carrying as much water as 15 Mississippi Rivers. It strikes a coast as a series of storms that arrive for days or weeks on end. Each storm can dump centimeters of rain or meters of snow. Meteorologists have had some difficulty predicting the amounts of precipitation, and therefore possible flooding. Satellite radars can track airborne water vapor well over the ocean but not so well over land, according to Martin Ralph, a research meteorologist with the National Atmospheric and Oceanic Administration (NOAA) Earth System Research Laboratory in Boulder, Colo., speaking at the annual American Geophysical Union conference here. Satellites also do not give a good assessment of winds within the corridor of water vapor, which affects how quickly they move rain inland.

Furthermore, the amount of flooding is strongly influenced by how wet or dry a region's soil is before and during the storms, which can only be accurately measured by sensors embedded in the ground. Knowing how much of the precipitation will fall as rain or snow is also important, because rain causes more immediate flooding whereas snow may cause delayed flooding.

The new warning system will provide all that information and more. Snow radars are being deployed in 10 major watersheds. Soil moisture sensors are being installed at 43 sites across California, which will be key to anticipating whether an incoming storm will produce heavy runoff, according to Michael Dettinger, a research hydrologist at the Scripps Institution of Oceanography in La Jolla, Calif., who was also speaking at the meeting. (Dettinger is co-author of a detailed article about atmospheric rivers in the January issue of *Scientific American*). Some of the snow radars and about three quarters of the soil sensors are already in place.

The centerpiece of the system will be four unique "atmospheric river observatories" located about 400 kilometers from one another. The units, about the size of a dump truck, look upward and show precise wind speed and direction at several altitudes, the elevation at which precipitation is rain or snow, and the total amount of water vapor above the site. They also indicate standard weather data such as temperature, humidity and atmospheric pressure. The first observatory is being installed right now in Bodega Bay. The others will be set up in Eureka, Point Sur and Goleta.

The partially completed system already proved its worth two weeks ago. When satellite imagery showed moisture accumulating over the central Pacific researchers drove a mobile observatory into northern California and began compiling data from it with the other sensors that were already operating. Forecasters were able to predict five days in advance that an atmospheric river would begin pummeling the state. True to the forecast, storms started hitting the coast on November 28 and lasted five days, dumping up to 38 centimeters of rain,



A mobile atmospheric river observatory
Image: Courtesy of NOAA

causing flooding and mud slides. Forecasters used the information to warn residents which rivers might flood when, and the state's Department of Water Resources used it to help decide whether to try to mitigate flooding by opening or closing dams and other structures along California's rivers.

NOAA has posted data from the initial tests online. When the system is complete the data it generates will be available to the public online, in real time. And the system could provide a model for better prediction around the world. Atmospheric rivers can strike the west coasts of most continents and landmasses; in mid-November a series of atmospheric-river storms caused the heaviest flooding in western England and Wales since the 1960s.

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Recent heat spike unlike anything in 11,000 years

By SETH BORENSTEIN, AP Science Writer
Updated 7:17 am, Friday, March 8, 2013

WASHINGTON (AP) — A new study looking at 11,000 years of climate temperatures shows the world in the middle of a dramatic U-turn, lurching from near-record cooling to a heat spike.

Research released Thursday in the journal *Science* uses fossils of tiny marine organisms to reconstruct global temperatures back to the end of the last ice age. It shows how the globe for several thousands of years was cooling until an unprecedented reversal in the 20th century.

Scientists say it is further evidence that modern-day global warming isn't natural, but the result of rising carbon dioxide emissions that have rapidly grown since the Industrial Revolution began roughly 250 years ago.

The decade of 1900 to 1910 was one of the coolest in the past 11,300 years — cooler than 95 percent of the other years, the marine fossil data suggest. Yet 100 years later, the decade of 2000 to 2010 was one of the warmest, said study lead author Shaun Marcott of Oregon State University. Global thermometer records only go back to 1880, and those show the last decade was the hottest for this more recent time period.

"In 100 years, we've gone from the cold end of the spectrum to the warm end of the spectrum," Marcott said. "We've never seen something this rapid. Even in the ice age the global temperature never changed this quickly."

Using fossils from all over the world, Marcott presents the longest continuous record of Earth's average temperature. One of his co-authors last year used the same method to look even farther back. This study fills in the crucial post-ice age time during early human civilization.

Marcott's data indicates that it took 4,000 years for the world to warm about 1.25 degrees from the end of the ice age to about 7,000 years ago. The same fossil-based data suggest a similar level of warming occurring in just one generation: from the 1920s to the 1940s. Actual thermometer records don't show the rise from the 1920s to the 1940s was quite that big and Marcott said for such recent time periods it is better to use actual thermometer readings than his proxies.

Before this study, continuous temperature record reconstruction only went back about 2,000 years. The temperature trend produces a line shaped like a "hockey stick" with a sudden spike after what had been a fairly steady line. That data came from tree rings, ice cores and lake sediments.

Marcott wanted to go farther back, to the end of the last ice age in more detail by using the same marine fossil method his colleague used. That period also coincides with a "really important time for the history of our planet," said Smithsonian Institution research anthropologist Torben Rick. That's the time when people started to first domesticate animals and start agriculture, which is connected to the end of the ice age.

Marcott's research finds the climate had been gently warming out of the ice age with a slow cooling that started about 6,000 years ago.

Then the cooling reversed with a vengeance.

The study shows the recent heat spike "has no precedent as far back as we can go with any confidence, 11,000 years arguably," said Pennsylvania State University professor Michael Mann, who wrote the original hockey stick study but wasn't part of this research. He said scientists may have to go back 125,000 years to find warmer temperatures potentially rivaling today's.

However, another outside scientist, Jeff Severinghaus of the Scripps Institution of Oceanography thinks temperatures may have been notably warmer just 12,000 years ago, at least in Greenland based on research by some of his colleagues.

Several outside scientists praised the methods Marcott used, but said it might be a bit too oriented toward the Northern Hemisphere.

Marcott said the general downward trend of temperatures that reversed 100 years ago seemed to indicate the Earth was heading either toward another ice age or little ice age from about 1550 to 1850. Or it was continuing to cool naturally until greenhouse gases from the burning of fossil fuels changed everything.

The reason the globe warmed after the ice age and then started cooling about 6,000 years ago has to do with the tilt of the Earth and its distance from the sun, said Marcott and Severinghaus. Distance and angle in the summer matter because of heat absorption and reflection and ground cover.

"We have, through human emissions of carbon dioxide and other heat-trapping gases, indefinitely delayed the onset of the next ice age and are now heading into an unknown future where humans control the thermostat of the planet," said Katharine Hayhoe, an atmospheric scientist at Texas Tech University, responding in an email.

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Silver age of cruising ahead for San Francisco?

By Anne Chalfant San Jose Mercury News Correspondent San Jose Mercury News

Posted:

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Picture three big, white, handsome cruise ships lined up along San Francisco's Embarcadero.

While you're at it, visualize yourself striding up a gangplank, a happy seagoer in the Bay Area cruise craze.

Now hold that thought. San Francisco is not yet a departure port for cruises in the way that, say, Seattle is.

But that could change with the maritime welcome mat laid out in late February. The opening of San Francisco's new James R. Herman Cruise Terminal promises a classy welcome to cruise passengers and issues an invitation to the cruise industry's new megaships, which this terminal can accommodate.

Just how big? Some behemoths built in recent years are up to 1,200 feet long -- that's almost four football fields -- and can carry 5,000 to 6,000 passengers. Most ships, however, will carry only half that many.

What also has changed is the greeting that awaits visitors. After sailing under the iconic Golden Gate Bridge, passengers will stroll down the gangplank into the new terminal, where floor-to-ceiling windows serve up a live, panoramic postcard of one of the world's most beautiful cities, complete with Coit Tower, Telegraph Hill and the Transamerica Pyramid.

But cruise passengers will have to save their oohs and aahs for early 2014, when the terminal interior at Pier 27 is completed (in the meantime, ships will continue to use the terminal at Pier 35). For the next eight months, the new terminal's 60,000 square-foot empty space is in the hands of its first occupant, America's Cup, which is also the economic force that kick-started the terminal's construction.

This summer, the bay will brighten with speeding sails of the world's fastest ships, 72-foot wing-sail catamarans. America's Cup Park -- akin to an Olympic Village for sailing teams, race officials and media -- will liven the new cruise terminal and several adjacent piers. The races kick off July 4 to Sept. 1 with the Louis Vuitton Cup. The 34th America's Cup finals are Sept. 7-22.

America's Cup organizers pledged as much as \$100 million to the city of San Francisco for port and harbor improvements, and the James R. Herman terminal, with its \$90 million price tag, got a chunk of that. A 2.5-acre waterfront park, Northeast Wharf Plaza, will be built beside the new terminal, adding waterfront recreation space and a good spot to gawk at a docked cruise ship.

The contract with America's Cup pushed decades of discussion to an action plan, said Peter Dailey, deputy director of maritime for the Port of San Francisco. With the new terminal's capability of accommodating the largest of ships, "We'll stay in step with the industry for the next 50 years," he said.

Bring it, cruise lines

One more thing the James R. Herman Cruise Terminal will accomplish -- actualizing the dream of the former port commissioner for whom the terminal is named. During his lifetime, Herman was a vocal proponent, urging the city to honor its maritime roots and again make San Francisco one of the world's great ports.

Building a new terminal is the first step. The next is to persuade cruise lines that starting a voyage in San Francisco -- not just stopping here -- is a good plan. More departures from home port would be a boon for Bay Area travelers. Monique Moyer, the port's executive director, said cruise lines have been checking in to discuss possibilities.

A major obstacle to San Francisco's becoming a major cruise embarkation port is geography -- the Pacific Ocean doesn't offer numerous destinations in the way the Caribbean does. And unlike East Coast ports -- a week's sail away from Europe -- San Francisco to Asia is a long haul.

Itineraries that currently make port calls in San Francisco follow routes to Alaska; the California Coast; Baja, Mexico; the Pacific Northwest; Victoria and Vancouver, British Columbia; Hawaii; plus a few to Tahiti. Those itineraries, plus a few world cruises and Panama Canal cruises, account for the 66 cruise ships making calls in San Francisco in 2013.

On the plus side, it might not be hard to persuade cruise lines to consider San Francisco as a departure port. The Bay Area is a sophisticated travel region and also home to retiring baby boomers with money to spend. South American itineraries might be popular here, given the elimination of the cost and time of flying to Miami.

Call it home

One company embracing San Francisco's maritime makeover is Princess, which is relocating its Grand Princess here from Fort Lauderdale, Fla. The ship, which arrives here March 16, is a gem. When it was introduced in 1998, it was the largest ship at sea, with 700 balconied cabins, back when 951 feet was really something. Thanks to a multimillion-dollar makeover in 2011, it is now outfitted with more dining and entertainment options, including movies shown poolside, Leaves Tea Lounge and Library, and One5, a late-night nightclub.

Home port status does not mean that Grand Princess will be hanging around. Typically, it will only be in port a short day between voyages, arriving at 7 a.m. to offload passengers, then loading a new set and embarking on its next sail at 4 p.m. Itineraries include Alaska; California Coastal; Wine Country Coastal; and a cruise to Hawaii, Tahiti and the South Pacific.

Like all cruise ships arriving this year, Grand Princess will be ushered into Terminal 35, the old terminal. The terminal, built in 1914, is bleak -- a windowless, unheated steel building that has all the charm of an empty aircraft hangar. Still, Pier 35 has history that dates back to the golden age of cruising, when around-the-world journeys were fashionable for the wealthy.

And it won't be scrapped anytime soon. When more than one ship visits San Francisco at the same time, that extra terminal will come in handy.

Anne Chalfant is a former travel editor for Bay Area News Group and author of the app "Cruise! A Guide for Ships and Trips."