Inhabiting Cycles Of Maritime Obsolescence
Redirecting the National Defense Reserve Fleet

By
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B.A. University of California Berkeley (2007)

Submitted to the Department of Architecture in Partial Fulfillment
of the Requirements for the Degree of Master of Architecture at the
Massachusetts Institute of Technology
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ABSTRACT

Defense is in a state of obsolescence. The metrics of risk have changed from threat of military invasion to that of weather. Infrastructure is in a state of transition. The Maritime Administration's National Defense Reserve Fleet (NDRF) has dwindled from 2,700 ships in 1946 to only 140 in 2013. Now, along with closure of over 350 military installations and their related infrastructures in the continental US, the 140 remaining sea-lift merchant vessels are deemed obsolete, no longer needed for global defense operations. This cycle of infrastructural obsolescence offers an opportunity to realign coastal sites of maritime service and production, within regional seaport operations, to mitigate the inevitable threat of a seismic and/or flood catastrophe while contributing valuable social utility through industrial ingenuity. Waterfront development must now be coupled with appropriate metrics of defense and redundancy, projecting a long term phasing for the future occupation of the post industrial estuary.

This thesis proposes a strategic redevelopment of obsolete maritime infrastructures that programs a regional sea-lift defense program for the San Francisco Bay as a prototype for inland bay regions. It realigns one of three remaining sites of the NDRF to serve a region with a 63% chance of experiencing an earthquake with magnitude of 6.7 or greater in the next 30 years resulting in the loss of water, power, and shelter for 60,000 people in 27,000 buildings. The project proposes reprogramming the remaining NRDF merchant vessels as floating water, power, and food utilities and staging strategic coastal port infrastructures on an entirely ship powered waterfront, beyond the grid. These proposed hybrid landscapes work together as a strategic urban model for phasing resilient seaports in highly vulnerable coastal regions. They invert the “hard,” land-borne conduits of power and water in favor of multiplied and thus redundant, “soft,” distributed, water-borne infrastructure delivering power, water, and food to support emergency urbanism.

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A Redirection of National Defense Reserve Fleets

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Love to my family who steer the ship when I get weary. Love to my friends who keep me afloat. Respect to my committee, who kept the narrative strong, and Miho, who kept it human. Thank you to Adrianna, Julian, David, Chris, Alexander, Anya, Oscar, Einat, Barry, Adi, and the Urban Risk Lab, without whom I would be in danger. To Hallie, Rosie, David, and Ben for the counsel and hugs I enjoy so dearly. To my mother whose words put the wind beneath my wings. To my brother whose leadership gives me direction when I am lost. To my father whose strength will endure the times. To the sun, the moon, and the tides without which the climate would never be right.
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Introduction
The horizon rises and falls. The fear of a coming tide comes and goes. The memory of what lies beneath the surface fades, hidden awaiting to be revealed. The history of shit. The dead. The almost dead. The almost alive. The objects that lie in a state of preservation to be awoken and revived are the focus of this thesis. The old, forgotten, decaying infrastructures. The derelict land. The toxic soil. The hands and machines that scrap. The channels of transport. The mobility of material assembled and disassembled. The age of reuniting the abandoned. Tracking the lost. The anti-waste. The anti-remediation. The newly constructed ecologies of security and power. The salvage. The sludge. The steel. The container. The vessel. The fleet. The island.

These cycles of obsolescence span generations. Span industries. World War II began the production of sea power in the United States, which advanced and delivered the first global excess. The offset of capital. A surplus of objects. As a result, World War II shipbuilding was perhaps the greatest combined effort of government and private industry in the Nation’s history, subsuming all resources to one end. Construction averaged a ship a day for four years, building, launching, and repairing some 4,600 vessels, literally turning mountains into war machines.


"When you invent the ship, you also invent the shipwreck; when you invent the plane, you also invent the plane crash; and when you invent electricity, you invent electrocution... Every technology carries its own negativity, which is invented at the same time as technical progress."

Paul Virilio
Decaying warships in limbo: Towing to Texas for scrap on hold

By Michael Gardner
Dec. 28, 2008

During their prime, these ocean warriors anchored just east of San Francisco were the pride of the country in times of war and peace. Alumni include a survivor of D-Day and a CIA spy ship built by Howard Hughes.

But today, decommissioned and decaying, about 55 of the ships will be towed to Texas for scrap if state water-quality regulators and federal authorities can settle a legal standoff over how to clean and fortify the vessels for their last voyage.

State regulators and environmentalists say the ships are rotting, shedding paint and other toxins into the water below their hulls and threatening irreversible damage to an already fragile Suisun Bay estuary.

"These are accidents waiting to happen," said Bruce Wolfe, executive officer of the San Francisco Bay Regional Water Quality Control Board, which has oversight of Suisun Bay.

"We need to get a program together that everyone can agree on and get those ships out of here."

Moving the vessels is risky. Outgoing ships could leave a trail of copper, mercury and other pollutants. The most unseaworthy threaten to break apart before reaching the Golden Gate Bridge.

The Federal Maritime Administration, which is responsible for a number of the vessels, insists that it is moving as aggressively as it can given time constraints and budget limitations. Agency officials say they are committed to working with the state to find ways to safely escort vessels to dismantling yards.

"This is a very unique problem. These are the only vessels in the world having these rules imposed on them," said agency administrator Sean Connaughton. "There are no accepted procedures. We are the guinea pigs."

It can cost taxpayers as much as $1 million to have one ship cleaned and towed through the Panama Canal for dismantling in Brownsville, Texas, according to various estimates. Dismantling companies then sell the scrap and keep the money.

Some officials are pushing to have the work done closer to the fleet, which they say would limit chances of harm as surplus vessels are towed out of Suisun Bay.

A fledgling California company, Allied Defense Recycling, is negotiating permits and a lease to reopen a dry dock at the nearby Mare Island Naval Shipyard, which closed 12 years ago. The British parent of BAE Systems San Diego Ship Repair, which has a dry dock facility in San Francisco, may be interested in servicing the mothballed ships.

Suisun Bay has been a naval storage yard for 60 years, with more than 300 anchored there at one time at the height of the program. The ships were shuttled in and out of service, except for those declared unseaworthy.

Eerily picturesque in the fog, the ghostly looking fleet sometimes draws gasps from motorists spotting the neatly lined-up rows for the first time as they drive across the Benicia-Martinez Bridge.

The approximately 70 ships stored in the bay today are in somewhat of a purgatory. About a dozen, still enjoy official "reserve" status, which means they could be drafted back into action. The others are only valued for scrap, if that.

From an overlook just off Interstate 680, the curious can pick out the star, the battleship Iowa. Built in 1943, "The Big Stick" saw action in World War II and the Korean War, but is probably most remembered for a tragic 1989 gun turret explosion that killed 47 crewmen on maneuvers.

Those who served onboard are campaigning for the Iowa to be turned into a floating museum in Vallejo, but
raising money is proving difficult. It remains in reserve status.

“The biggest, best battleship ever made,” said retired Rear Adm. Gerald Gneckow, who was at the Iowa’s helm from 1984 to 1986.

There are other less-famous workhorses. Among those: the Sperry, a submarine tender deployed 10 days after Pearl Harbor and frequently operating out of San Diego. There is the amphibious warship Thomaston, also home-based in San Diego, which was part of the fleet sent to evacuate Saigon during Operation Frequent Wind in 1975.

One-time members of the fleet include the spy ship Glomar Explorer built by Howard Hughes as part of a secret CIA mission to raise a Russian submarine in 1974. Its reward was being auctioned, dismantled and reincarnated as that of deep sea oil-drilling platform. More fortunate was the Jeremiah O'Brien, a rare survivor of the D-Day invasion in 1944. Today, the Liberty ship is a floating museum on Pier 45 in San Francisco.

Those ships still moored in Suisun Bay are in the middle of one last battle, this one in a courtroom. A coalition of environmental groups filed a lawsuit last year demanding that the Maritime Administration clean up its fleet after years of fouling the bay with lead, mercury and waste oil, among other pollutants.

Armed with a federal study, the groups argue that the fleet has discharged at least 20 tons of heavy metals into the water.

“If the Maritime Administration was a private business, they would have been criminally prosecuted by now,” said Michael Wall, an attorney for the Natural Resources Defense Council. A trial is not expected until summer.

State water-quality regulators joined in the litigation this year, setting up a court confrontation unless the incoming Obama administration can strike an agreement.

In addition to an alleged general lack of maintenance, the state is critical of scrubbing, or “scamping,” the ships. That cleaning process, regulators say, allows pollutants such as paint to peel off and escape into the water.

Wolfe, the bay-area regulator, accused the Maritime Administration of “being slow to react” after warnings that some of its practices were threatening the waterways.

“They’ve found reasons not to comply. That’s been frustrating to us,” Wolfe said.

The Maritime Administration said it is doing its best given tight budgets and conflicts between federal responsibilities and state requirements.

“We have to look at this from the national perspective. The only fleet we have issues with is in California,” said Connaughton, the federal agency’s administrator.

Connaughton said dry docking has complications, including whether the ships are strong enough to be placed on blocks. Pilot programs are in the works to limit the amount of pollutants that escape into the water.

The agency also must ensure that regulations do not become overly burdensome, deterring interest or raising the disposal cost, he said.

“We’ve been exploring every option,” Connaughton said.

Environmentalists remain steadfast.

“The ghost fleet doesn’t belong in Suisun Bay anymore,” said Sejal Choksi of the group San Francisco Baykeeper in announcing the litigation. “It’s been haunting our waters for far too long.”

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National Defense
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"NUCLEAR" ERA: 2,603 vessels stored at 8 sites

Map of National Defense Reserve Fleet Sites in 1946
"WEATHER" ERA: Approx. 132 vessels remain at 3 sites

Map of National Defense Reserve Fleet Sites in 2013, with vessel tonnage
The Beaumont Reserve Fleet

"is an anchorage of the National Defense Reserve Fleet (NDRF) located on the Neches River in Beaumont, Texas. Originally one of eight NDRF fleet sites scattered across the country, BRF is currently one of three and the only the anchorage on the Gulf Coast.

The original course of the Neches River, which flows in a generally southeasterly direction toward Lake Sabine and the Gulf of Mexico, took several meandering bends just south of Beaumont, Texas. In 1946, the government excavated the largest of these bends and straightened the river channel. The result of the removal of nearly 42 million cubic yards of spoils, the McFadden Bend Cutoff is home to the BRF. The fleet accepted its first vessels in 1948.

In addition to the Ready Reserve Force (RRF), the NDRF consists of a variety of obsolete commercial vessels awaiting disposal. The NDRF also hosts many decommissioned U.S. Navy auxiliary vessels. These vessels arrive at the fleet at the end of their military usefulness, and are typically transferred by the U.S. Navy to the Maritime Administration (MARAD) for disposal.

BRF currently hosts non-retention, retention, and reimbursable custody vessels. Non-retention vessels are those that MARAD has deemed to no longer be militarily useful. Retention vessels are maintained for logistics support, training use, or long term activation. Reimbursable custody vessels are non-NDRF government vessels (such as those owned by the U.S. Army, Navy, Coast Guard, or the National Oceanic and Atmospheric Administration) that are stored at each fleet site in exchange for a maintenance fee."

Source: MARAD

SS American Osprey
SS Cape Florida
SS Cape John
MV Cape Lambert
MV Cape Lobos
SS Chesapeake
SS Diamond State
SS Equality State
USS Escape [ARS-6]
SS Gulf Banker
SS Gulf Trader
SS Mission Buenaventura
SS Mission Capistrano
SS Mount Vernon
SS Ohio [Departed Fleet - Recycled]
USS Ortolan [ASR-22]
SS Pioneer Commander
SS Pioneer Crusader
SS Potomac
USNS Sirius [AFS-8]
TS State of Maine
Aerial view of Beaumont, Texas, NDRF site. (Source: Google)
The James River Reserve Fleet (JRRF) is an anchorage of the National Defense Reserve Fleet (NDRF) located on the James River at Fort Eustis, Virginia. It is the oldest of the original eight NDRF fleet sites and is currently one of three that is still in operation.

A reserve fleet of wood- and steel-hulled ships was established at Fort Eustis, then Camp Eustis, as far back as World War I; the fleet was also used for inactive vessel lay-up following the war. Many of the wood-hulled ships were later removed to Mallows Bay, Maryland. At the start of World War II, there were nearly 300 ships at JRRF, although all vessels were activated at the start of the war.

Section 11 of the Merchant Ship Sales Act of 1946 established the National Defense Reserve Fleet (NDRF) to serve as a reserve of ships for national defense and national emergencies and the James River reserve anchorage became part of the NDRF. Vessels began re-entering JRRF shortly after the war's end, and the fleet reached its peak size in 1950 with nearly 800 ships.

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Source: MARAD

USNS Benjamin Isherwood
SS Cape Alava
SS Cape Alexander
SS Cape Ann
SS Cape Archway
SS Cape Avinof
USS Cape Cod (AD-43)
SS Cape Johnson
SS Cape Juby
SS Cape Mendocino
SS Cape Nome
USNS Harkness (AGS-32)
USNS Henry Eckford (T-AO-192)
MV James McHenry
USS Merrimack (AO-179)
USS Monogahela (AO-178)
TS Patriot State
USS Platte (AO-186)
USNS Range Sentinel (T-AGM-22)
SS Resolute
USS Shenandoah (AD-44)
Sturgis (MH-1A)
USS Sylvania (AFS-2)
USNS Vanguard (AG-194)
USS Yellowstone (AD-41)
Aerial View of James River, Virginia, NDRF site. (Source: Google)
The Suisun Bay Reserve Fleet

The Suisun Bay Reserve Fleet (SBRF) currently hosts non-retention retention, and reimbursable custody vessels. Non-retention vessels are those that the MARAD has deemed to no longer be militarily useful. Retention vessels are maintained for logistics support, training use, or long term activation. Reimbursable custody vessels are non-NDRF government vessels (such as those owned by the U.S. Army, Navy, Coast Guard, or the National Oceanic and Atmospheric Administration) that are stored at each fleet site in exchange for a maintenance fee.

Source: MARAD
Aerial view of Suisun Bay, California. NDRE site. (Source: Google)
1,000,000,000
cubic feet

Aerial views of remaining ships moored in Suisun Bay, California
SALVAGE
The average ship is designed to be seaworthy for 30 years. Once deemed obsolete, vessels take on new meaning. Historically, the National Defense reserve fleet has served many salvage titles.

MARAD reports, “For example, in 1953, when the U.S. Department of Agriculture needed storage space for large volumes of government-owned wheat, it turned to the Reserve fleet. Over the next ten years, more than 53.6 million bushels of wheat were loaded into 231 ships. About a quarter million bushels of wheat were stored in each ship, with 70-90 ships holding wheat at any given time. The last ship was unloaded in 1963.”

“In the early 1960s, as the Vietnam War was growing more intense, four T-2 tanker ships went back into action from the Reserve Fleet, sailing under their own power to Asia. There they were used to supply electric power from their 10,000 horsepower generators to Vietnamese coastal communities that had lost their power production to the fortunes of land war.”

Continuing on, Countermeasures Evaluation Branch of the U.S. Naval Radiological Defense Laboratory developed the Civil Defense Utilization of Ships and Boats. It was the first time the Navy considered a civilian occupation of obsolete infrastructure, as it studied the feasibility of deploying surplus vessels as nuclear fallout shelters. The fallout never came and the Cold War is history.

Now, the Basel Action Network says the plans are for thousands of tons of steel to be stripped from hulks and sent to recycling smelters in Monterrey, Mexico. Remnants of battle cruisers and merchant marine freighters could return to the U.S. as auto parts and home appliances.
“As a part of its overall study of suitable shelters throughout the nation, the Office of Civil Defense (OCD) is interested in determining possible shelter spaces that might be available through unconventional sources, including ships and boats. Ships and boats were also to be considered for other possible civil defense uses, including food and supply storage, electricity generation, water purification, and civil defense headquarters. The purpose of this study then is a broad one, intending to delineate the possible civil defense applications of ships and boats, and to evaluate the ultimate usefulness of these vessels in the national civil defense effort.”

Source: MARAD
Aerial View of the National Defense Reserve Fleet in Suisun Bay, California, in 1963. The fleet covered an area the size of 84 city blocks.

(Photo courtesy Maritime Administration)
"With sufficient warning of a nuclear attack, merchant ships and boats could evacuate up to 12,500,000 persons from target areas. In addition, Naval reserve fleets with only minor modifications could be used to house another 500,000 persons. Further, at a cost of about $90 per occupant, 800 of the Liberty ships (currently being scrapped at the rate 50 per year) in the Maritime Administration's reserve fleets could be converted into ship shelters that would accommodate an additional 8,000,000 persons."

Source: MARAD
Visual: "Ship Utilization as a Function of an Attack Time Continuum"
(Illustration courtesy Maritime Administration)
"Various ways in which ships and boats might supplement the overall civil defense program were investigated. Both merchant and reserve ("mothball") fleet ships were considered for the part they might play in a lifesaving, life-sustaining civil defense capacity. Data for two port cities were analyzed to obtain information on population distribution and shipping activity. Engineering feasibility studies were made of the use of ships as personnel shelters and the availability of ships' utilities for use by shore installations. The protection offered from nuclear fallout radiation was calculated for two classes of ships. It was concluded that ships and boats could provide evacuation or fallout-shelter facilities, or both, before or during a nuclear attack. For the post attack situation, ships could serve as headquarters, hospitals, living quarters, storehouses, and prime producers of electrical power and potable water. It is recommended that further studies be made of selected port cities to determine how ships and boats could best be used to supplement present civil defense capabilities of these cities."

Source: MARAD

Reber Plan for San Francisco Bay, 1967
A. Floating Fallout Shelter (converted Liberty) Moored at Pier

B. Evacuees Board Beached Fallout Shelter (converted Liberty)

C. Moored Nest of Six Liberty Ships Used for Material Storage

D. Blast and Radiation Shelter Used as Command Center (buried Battleship)

Image: "Potential Ship Emplacement Conditions" (Illustration courtesy Maritime Administration)
<table>
<thead>
<tr>
<th>POTENTIAL USE</th>
<th>ACTIVE VESSELS</th>
<th>INACTIVE VESSELS</th>
<th>NATIONAL DEFENSE RESERVE FLEET</th>
<th>NAVAL RESERVE FLEET</th>
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</thead>
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<tr>
<td></td>
<td>PASSenger</td>
<td>GENERAL CARGO</td>
<td>TANKER</td>
<td>SMALL BOATS</td>
</tr>
<tr>
<td>&quot;AS IS&quot; SHELTER and/or EVACUATION</td>
<td>○</td>
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<td>●</td>
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<td>●</td>
</tr>
<tr>
<td>CONVERTED SHELTER</td>
<td>●</td>
<td>●</td>
<td>○</td>
<td>●</td>
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<td></td>
<td>●</td>
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<tr>
<td>CD HEADQUARTERS CD HOSPITAL</td>
<td>○</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>STORAGE (FOOD, EQUIPMENT, WATER, FUEL, etc.)</td>
<td>▲</td>
<td>▲</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>FLOATING UTILITY (WATER PURIFICATION, POWER GENERATION)</td>
<td>○</td>
<td>●</td>
<td>○</td>
<td>●</td>
</tr>
</tbody>
</table>

Legend: Ship potential for various CD uses.
- ○ PROMISING
- ▲ POSSIBLE
- ● HIGHLY IMPROBABLE
- ★ PROMISING AFTER MAJOR SHIP MODIFICATION

Image: "Civil Defense Utilization of Maritime and Naval Ships"
(Illustration courtesy of Maritime Administration)
Image: "Inboard Profile of a Converted Liberty Ship Showing Deposit Radiation Reduction Factors at Various Points" (Illustration courtesy of Maritime Administration)
Global Disposal

"The ship recycling industry in the United States dates back to the 1950's, when an abundant supply of U.S. military vessels following WWII formed the National Defense Reserve Fleet (NDRF). The U.S. Maritime Administration (MARAD) managed 2,277 NDRF vessels at that time. This abundant supply of end-of-life vessels spawned the development of a strong U.S. ship recycling industry and a successful public-private disposal partnership that lasted throughout the 1960's and 1970's. By 1974, 30 U.S. recycling companies were fulfilling ship disposal contracts at U.S. yards, and with the capacity to recycle all government end-of-life vessels.

With the Cold War military buildup throughout the 1980's, ship disposal declined significantly in the U.S. as reserve fleets were maintained at maximum capacity. During this same period, ship recycling operations shifted overseas to South Asia due to lacking enforceable environ, which lacked enforceable environmental and occupational health and safety regulations and offered cheap labor. As a result, the U.S. ship recycling industry nearly collapsed entirely."

Map of global shipping lanes and of ship breaking sites
National Disposal

The backlog of government vessels that have supported the U.S. Industry since 1950 will be eliminated by year end 2015. There are currently 191 privately owned merchant ships operating under the U.S. flag (>10,000 DWT), representing 9 million dead weight tons, or 2% of the total global shipping tonnage in operation.

Pacific Coast:
Allied Defense Recycling
64,000 TONS

Atlantic Coast:
BB Metals
150,000 TONS

Gulf Coast:
Allstar Metals, Bay Bridge Texas
Gulf Coast, ESCO Marine Gulf
Coast, International Shipbreaking,
Marine Metals, Southern Recycling
930,000 TONS

TOTAL ANNUAL TONNAGE IN 2015: 1,144,000
Image: Map of National Defense Reserve Fleet Sites in 2013 with respective tonnage scrapped capacity.
Historic Preservation

General Standards for Treatment of Historic Vessels

1. A historic vessel shall be put to a use, either continuing or new, that requires minimal change to its historic qualities and appearance.

2. The defining characteristics of a vessel shall be retained and preserved. The removal of historic materials or alteration of features and spaces that characterize a vessel shall be avoided.

3. Each vessel shall be recognized as a physical record of its time, place, and use. Changes that create a false sense of historical development, such as adding conjectural features or architectural elements from other vessels, shall not be undertaken.

4. Most vessels change over time; those changes that have acquired historical significance in their own right shall be retained and preserved.

5. Distinctive features, finishes, and construction techniques or examples of craftsmanship that characterize a vessel shall be preserved.

6. All vessels shall be subject to a program of preventive maintenance. Deteriorated historic features and their materials shall be repaired rather than replaced. Where the severity of deterioration requires removal of a distinctive feature, the replacement shall match in design, color, texture, and other visual qualities; and, where possible, material. Replacement of missing features shall be substantiated by historical, physical, or pictorial evidence.

7. Every reasonable effort shall be made to protect and preserve physical evidence of features previously removed, replaced, altered, or otherwise affected in the course of a vessel’s history.

8. Chemical or physical treatments, such as sandblasting, that cause damage to historic materials shall not be used. The surface cleaning of vessels, if appropriate, shall be undertaken using the gentlest means possible.

Vessels preserved as museums: 173
Number of preservation sites: 164

Source: The U.S. Secretary of the Interior’s Standards for Historic Vessel Preservation Projects
SINKEX

“SINKEX was live fire training exercises conducted by the U.S. Navy to practice gunnery, torpedo accuracy, and missile drills on decommissioned Naval Warships. It gives the U.S. Navy the opportunity to practice on live targets, using real ammunition, and observing the results. In 2012 the U.S. Maritime Administration (MARAD) has adopted a new policy that terminates the federal artificial reefing program that allowed the scuttling of old ships for so-called “artificial reefs” – a practice that dates back to the Liberty Ship Act of 1972. Since the program’s inception, approximately 45 ships have been disposed of at sea, along with untold tons of toxic substances such as polychlorinated biphenyls (PCBs) and heavy metals built into each vessel, as well as many millions of dollars worth of steel and non-ferrous metal resources. U.S. based environmental organization Basel Action Network (BAN), which has actively campaigned against the government-sponsored ocean dumping program, hails this news as a victory for U.S. jobs in the domestic ship recycling industry and a win for the environment.”

Source: MARAD
http://www.marad.dot.gov/ships_shipping_landing_page/ship_disposal_program/sinkex/SINKEX_PROGRAM.htm
The Sinking of the USS Orkanski and resulting dive site
Scraping: Dirty Jobs

Hazards:

Asbestos—in hanger liners, mastic under insulation, cloth over insulation, cable, lagging and insulation on pipes and hull, adhesive, gaskets on piping connections, and valve packing.

Polychlorinated biphenyls (PCBs)—in rubber products such as hoses, plastic foam insulation, cables, silver paint, habitability paint, felt under septum plates, plates on top of the hull bottom, and primary paint on hull steel.

Lead—from lead and chromate paint, lead ballast, batteries, generators, and motor components.

Hazardous material and chemicals—including heavy metals in ship transducers, ballast, and paint coatings; mercury in fluorescent light tubes, thermometers, electrical switches, light fittings, fire detectors, and tank-level indicators; and chlorofluorocarbons (CFCs) in self-contained refrigeration devices such as water coolers and small freezer units.

Excess noise—associated with grinding, hammering, metal cutting, and other activities.

Fire—from ignited insulation, matting, lagging, and residual fuel; and from lubricants and other flammable liquids.

Hazardous Work Activities


Operations involving cranes, gear, and equipment for material handling. Cutting and welding operations and use of compressed gas. Activities involving scaffolds, ladders, and working services.

Source: OSHA
Brownsville, Texas, ship recycling berths and work conditions
Risk
Risk Urbanism is nothing new. Auxiliary water supply, fire houses, pump houses, fire boats, manifolds, and emergency management is central to the defense of any viable urban condition. Much of this infrastructure remains invisible, underground, hard piped, and controlled by private utility. Power and water is the heart of function, while remaining symbiotic to one another for control and containment.

The infrastructure necessary to house these basic utilities are built like fortresses, windowless concrete bunkers to withstand the test of time. However, nothing is for certain and the potential of failure is always possible.

In 1906 San Francisco shook to a magnitude 7.2 earthquake, breaking gas lines and starting a fire that destroyed most of what did not crumble in the seismic event. Camps were deployed in parks as men women and children worked to repair the gas and water an eventually the rest of the city.

Eighty-three years later, San Francisco suffered another seismic event, this time only a 6.7 magnitude. Bridges collapsed, water mains burst, freeways crumbled destroying 25,000 buildings and leaving 40,000 people homeless.

In association with tsunami, hurricane, or typhoon, seismic events have crippled an increasing number of populations at an accelerated rate, proving that the largest catastrophic threat is that of weather. Land based infrastructures can be engineered to resist these forces, but, it is argued that a distributed flexible infrastructure that is independent of the grid has a much higher likelihood of adapting to and serving populations in high risk areas namely coastal areas especially those found around the Pacific Rim.

In contrast to land-borne architecture which is static in nature, water-born architecture, an ancient craft, is dynamic in nature. Buoyant vessels can overcome flood and is designed to rise and fall with the swells.

How can buoyant infrastructures add security to existing out-moded utilities? How can we design and think about urbanism as a metric of safety as profit? How can defense be realigned with true risk and how can insurance be distributed until there is redundancy?
CHANCE 7.2 MAGNITUDE EARTHQUAKE HITS SAN FRANCISCO IN NEXT 30 YEARS

60%

60K HOMELESS

Image: Waterway rights, port and coastal vulnerability map of San Francisco Bay. Traffic data visualized by Eric Fisher
Land-borne infrastructures and failure potentials, San Francisco Bay area
Detail: Waterway rights, port and coastal vulnerability map of San Francisco Bay. Traffic data visualized by Eric Fisher.
Port typologies

- anchored
- cargo
- dry bulk
- liquid bulk
- dry dock
- pier
- ferry terminal
- canal
submarine gantry  submarine gantry  drydock 1  machine shop
nuclear research  drydock 2  drydock 3  drydock 4

Mare Island, California, infrastructures
Axonometric map of San Francisco's waterfront showing zones of liquifaction in red and berthing points for mid-range merchant vessels.
water tower
cement silo
floating drydock
turbines
billboard
swimming pool
tidal pools
berms
San Francisco, California, bayside infrastructures
Map of China Basin water access, San Francisco, California
Wharf History
The Decline of the Port

A look at the transformation of the Port of San Francisco

The 1950's: Infrastructure and Operations Problems

One of the senate committee's basic findings was that the decrease in shipping was related to infrastructural and operational problems which caused "the harbor, as composed of the various ports located along its shores, (to be) not fully competitive with other major United States harbor regions." Labor problems were seen as key in this regard. The report asserted that "a long record of tie-ups has done much to shake the confidence of shippers on the harbor's ability to move cargoes without interruption of services." But even while acknowledging that Bay Area ports needed modernization and had a history of labor trouble, the senate committee optimistically offered that ports needed only to improve "traffic promotion, trade development, and rate protection" in order to be competitive. The report neglected to stress the importance of shifting world trade routes and competition from other West Coast ports, especially Seattle and Los Angeles/Long Beach.

The Port of San Francisco also faced other problems that hindered its ability to compete for trade, particularly with the neighboring Port of Oakland: longer waiting time at docks, loss of the pallets used to convey goods between ship and shore, and drivers' hesitation to subject their trucks to additional wear from driving over the hills in and south of San Francisco (as opposed to more direct or flatter routes from the East Bay). Pilferage of cargo also concerned shippers.

Many of the port's facilities were in poor physical condition; many piers were outmoded, in need of repair, and had pier sheds with internal support columns that hindered the movement of goods. Furthermore, the senate committee found that after World War II, trucks accounted for 80% of the movement of goods once off-ship, eclipsing rail transport. Since many of the port's piers had narrow aprons designed to accommodate rail access, which made maneuvering trucks quite difficult, this was a real problem. Yet another difficulty was that, even before the arrival of giant container ships, general cargo ships were themselves getting bigger. Many of San Francisco's piers were not large enough to accommodate the new ships properly, and sheds had insufficient floor space.

Land Use Changes

By the end of the 1950s, the waterfront north of the Bay Bridge was faced with a problem affecting many central cities. Industry, particularly heavy industry and other activities which relied on material brought through the port, was abandoning San Francisco. The port's connection to nearby inland areas was eroding. Traditionally, production plants had been multi-storied and located near inputs—that is, near raw materials requiring processing and/or packing. But businesses had begun to leave their waterfront locations in order to take advantage of cheaper suburban sites—cheaper because changes in production and warehousing had begun to make multi-story facilities obsolete.

A Negotiated Landscape

Jasper Rubin
Map of historical fill overlayed with dominant transit type, Maritime Channel, San Francisco, California
Map of proposed maritime channel at Maritime Plaza, San Francisco, California
Timeline of San Francisco, California's maritime industry
1914 assassination of Archduke Franz Ferdinand of Austria, the heir to the throne of Austria-Hungary, by a Serbian nationalist in Sarajevo, Austria-Hungary

1893 The World’s Columbian Exposition

1893 GREAT DEPRESSION

1865 EARTHQUAKE

CARRIE STREET

CHICAGO WORLD'S FAIR

BETHLEHEM STEEL MILL

ESTABLISHED

1885

Carnegie Mission

Established With Bethlehem Steel

1885
Design
"It took the 1989 Loma Prieta earthquake to turn things around. Removal of the Embarcadero Freeway freed a significant amount of land for re-use and provided an opportunity for San Francisco to re-assess the waterfront and its connection to the city. In 1990, San Franciscans passed Proposition H by the slimmest of margins, banning hotel development on the waterfront and requiring the port to come up with a land use plan.

In 1997, nearly 30 years after becoming a city agency, the port released its first comprehensive Waterfront Land Use Plan. The plan has gone a considerable distance in creating consistency between port, planning department, and BCDC land use policies. It remains to be seen, though, whether the plan will successfully guide new development on the waterfront. Regardless, had such an effort been made at the time of the transfer, the city’s waterfront might be a much different place now.

Though many factors-geographical, technical and logistical-led to the Port of San Francisco’s decline, collaborative and forward-looking planning will go a long way in facilitating its revitalization. While the particulars of land use policies may (and should) be debated, the slow pace of progress along the waterfront demonstrates why this kind of planning is so necessary.

A Negotiated Landscapes

Jasper Rubin

A regional system of roving aquatic infrastructures enables an urbanism that can anticipate and activate continuously along the waterfront. It offers a new metric to engage a partnership between counties and share resources across a region independent of bridges and aqueducts. Minor waterfront upgrades to existing ports, piers, and channels would bring a phased revitalization that has been lacking while offering a regional scale between a water emergency transport and a global cargo.

Shifting utility from mountainous hydro-electric to estuarine hydro-electric requires the technology of desalinization and ion production for fuel cell batteries. Before 2020, the San Francisco Bay already intends to build 2 desalinazation plants, why not consider them floating? Power and water on demand. Charge points, check points, gates, taxes, tariffs, plug-ins and deployment. What would it take to make this a reality? What pilot project would allow this to phase into a feasible system, not just a spectical or leisure class stunt.

The prototypical scenario charges the ferry building and the San Francisco Port Authority with the governing of a new draw bridge and channel dredged back to the original shore line which is now the heart of the city. The transient waterborne vessels would offer changing program on a weekly or monthly schedule, providing water and power utility while also integrating social utility in the form of education, health, fitness, exhibition, and workshop ie mixed use. The plug-in infrastructure would result in five urbanisms depending on the vessel berthed at dock. Imagined as a city block that would renew every week, upset the routine, change the fitness, and increase the health of the wharf, the regional sea-lift campaign reaches way back for a nostalgia that gave rise to San Francisco and reconsiders the origin of The Embarcadero.
Proposed charging facility at Mare Island shipyard
Proposed phasing and utility at Mare Island shipyard
Typical cargo vessel from National Defense Reserve Fleet
Prototypical vessel programming
Prototypical vessel programming

water

exhibition

food
Prototypical vessel programming
Aerial view of proposed maritime channel at Maritime Plaza, San Francisco, California
Aerial View Systems: Park Infrastructures
Aerial View Systems: Shelter and camp infrastructure
On-shore infrastructures, kit of parts
Transforming infrastructure as shelter
In-ground water cistern/reservoir

On-shore transformer as public art
Section @ Water berthing
Section @ Power Berthing
Section @ Aquatic bathhouse
Past Futures
Experimental Architecture:
Peter Cook

“The real value of engineer-designed mills, warehouses and bridges lies in their contribution to the relationship between context and dynamic or between problem and effort. Here, for once, a practical problem could lead to a piece of pure inventiveness. Experiment was not necessarily dramatic—but just the product of the problem—and if it did not work its failure could be seen as well. Climate forces the climate of craft. Swiss and German include precise engineered details while the Mediterranean is looser and more raw and sculpturous. Italian and French are expected to venture into new territory and dare... 

Expression Technique and Presentation
Innovators have three choices: to place their work in the extra-architecture context; to force a gradual evolution out of the mainstream of their city or region; or to set up a cradle of reference for their work that is international and concerned only with its own values.

Orthodoxies:
Organic, Methodical, Opportunistic, Scientific, Utopian, and Tasteful."
Hans Hollein, Aircraft Carrier Projects, 1964
Monumental re-appropriation
Cedric Price, Potteries Thinkbelt, 1964
Vessel Thinkdock
Vessel city
Vessel Operations
Presentation boards from thesis defense
SYSTEMS AND SCENARIO
THE EVERYDAY EVENT

SERIAL SECTIONS
INFRASTRUCTURAL WHARF

SHIP TO SHORE
UNWINDING PAST

WE ARE IN SITE
PUBLIC PARK
INFRASTRUCTURE
Jury

Mark Jarzombek
Gediminas Urbonas
Adele Santos
Miho Meezerahow
Mark Gaulthorp
Rafi Segal
Stanford Anderson

and some harvard blokes
Bibliography


