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June, 1982

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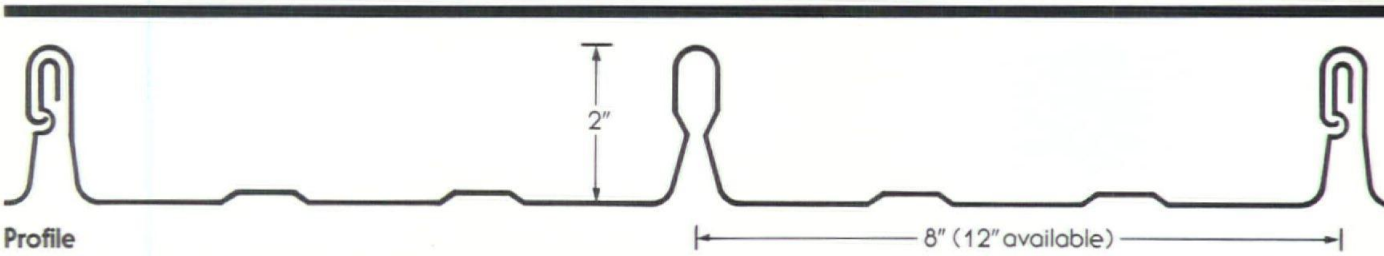

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HAWAII ARCHITECT

Volume 11, No. 6 June, 1982

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MESSAGE FROM GOVERNOR GEORGE R. ARIYOSHI

I am very pleased to extend, on behalf of the people of Hawaii, congratulations and best wishes to all whose dedicated effort has made possible the first national convention of the American Institute of Architects in Hawaii, to be held June 6 to 9, 1982.

With the theme, "A Quest in Time," this gathering is particularly auspicious because it is the AIA's 125th anniversary.

Hawaii is indebted to its architects for the grace, beauty, and utility of many superb buildings and other structures, some of which have won national awards for excellence. The gathering in our Islands of distinguished architects from overseas, will result in a valuable sharing of ideas and experiences for mutual advantage.

To the American Institute of Architects, we extend our congratulations on its 125th anniversary. To our visitors, and to all others associated with this convention, we extend our warmest aloha.

George R. Ariyoshi

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Aloha from the Mayor to the Delegates attending the 1982 AIA National Convention

The Hawaii Society/American Institute of Architects is honored to host the first National AIA Convention in Hawaii and joins me in welcoming you to our City.

I am confident that the thousands of mainland AIA delegates will be impressed with the scope of material presented by the three nationally regarded speakers who have agreed to participate in this most important event.

While your convention business is your first priority, I hope you will take time to sample the fine hospitality of our island people. We are proud of our capital city and always eager to share with visitors the beauty of our land and the warmth of our people.

As you conclude your visit with us, I hope you will find that you have been enriched by the professional associations you made and the island friendships you developed.

On behalf of the people of the City and County of Honolulu, I extend our leis of Aloha to all of you who are attending this convention and offer our best wishes for a successful and memorable session.

Eileen R. Anderson

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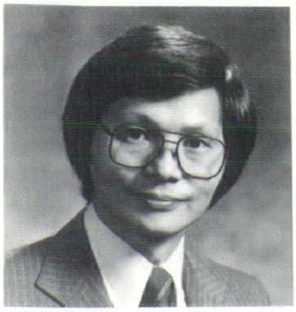

The Convention in Hawaii

by Francis S. Oda, AIA
President, Hawaii Society/AIA

Futurists such as Robert Theobald have called Hawaii the ideal test tube for studying our global future. The isolation of the Islands has created a unique Hawaiian ecology with great natural assets, yet our position in the center of the Pacific has linked us with the U.S., Canada, Australia, Japan, Korea, China, the Philippines, and other Pacific Rim countries. Our people are descended from the cultures of these countries and have evolved a unique and identifiable society known for its diversity, racial harmony and hospitality. On this spaceship earth, Hawaii may well be a life raft.

When Hawaii was selected as the site of the 1982 National AIA Convention, few realized how appropriate this island test tube was for "A Quest In Time." As architects and scientists look at the implications of colonization of space and the oceans, it might be helpful to imagine how the early Hawaiians felt as they dreamed of colonies far beyond their vision; long before the European world considered an alternative to the earth being flat. In their canoes, these voyagers traveled thousands of miles and colonized these tiny specks in the Pacific that we call Hawaii. They went back and forth to the Marquesas forming a lifeline much more ethereal than that provided by the space shuttle. The vision of these ancient mariners and the activities of modern Hawaiians offer a serendipitous backdrop for the bold thrust of the convention.

When the Hawaiians looked at the sky, they did not stop at the beautiful clouds and blue expanse over Waikiki but saw the stars and planets. The heavenly bodies meant life or death to these navigators, and the stars of the northern and southern skies became a part of their history, culture and art. Today, modern Hawaiians and others from around the world look into the deep recesses of space from atop Mauna Kea, or "White Mountain." Reaching 13,000 feet above sea level, Mauna Kea is the highest point in the Pacific, the tallest mountain measured from its base (below sea level) and is possibly the best optical and millimeter telescope site in the world. Six telescopes run by the University of Hawaii, NASA, the British, Canadians, and French may be joined by six to eight others by the year 2000. With observatory sites also on Mauna Loa and Haleakala, Hawaii continues in the vanguard of space study.

When the ancient Hawaiians looked at the vast expanse of ocean off our shores, they saw not only the sparkling surf but also an undersea world full of resources and natural beauty. Their land ownership patterns reached out to the reefs and ancient Hawaiians recognized undersea seasons, geological patterns, and ecological relationships in ways even beyond our current understanding.

Modern Hawaiians continue to look to the sea for energy, mineral resources, food, and beauty. Off the shores of the Big Island (Hawaii), the differential of surface and subsurface ocean temperatures is being harnessed to generate electricity in a project called Ocean Thermal Energy Conversion (OTEC). This federally funded effort is the only one of its kind in the world and may provide a reliable source of non-petroleum-based energy and fresh water (a by-product) from our most ubiquitous global resources, the oceans.

Efforts to mine the ocean floor for manganese nodules are under consideration. These nodules, about the size of baseballs, are rich with manganese, gold, silver and

other minerals. They litter the expanse between Hawaii and South America and are especially abundant off our shores.

Like our ancestors, modern Hawaiians look to the sea for food, not only for fish and crustacea but also seaweed and a broad assortment of soft and wiggly invertebrates. Modern pioneers are even changing fish from a wild and hunted animal to a domesticated and harvested food source. Aquaculture (part of prehistoric Hawaii) is the growing of fish, prawns, oysters, clams, and more in ponds. Ancient and modern ponds are to be seen along the north shore of Oahu.

When the Hawaiians looked at their mountains, they saw below to the Islands' volcanic origins. The awe with which Hawaiians regarded this primordial force was expressed in religion and culture. Today, modern Hawaiians translate this force into electricity through geothermal conversion. We also harness the wind to make electricity in "wind farms." Our fields of sugar cane are also bio-mass fields of energy. Our sun which fries tourists also heats our water.

From the ancient past to future planning, Hawaii and its citizens have had the desire, stimulated by need, to reach beyond conventional wisdom. We, therefore, invite the members of the American Institute of Architects to share this understanding in "A Quest in Time." When you look to the clear blue sky, see beyond to the stars. As you view the surf, look into an undersea world of beauty and potential. When you look to our mountains, see the very origins of our land. When discussing the environments of lunar and undersea colonies, consider that the genesis of Hawaii's settlement may well have been the result of a similar grouping of wild-eyed visionaries in the Marquesas Islands. HA

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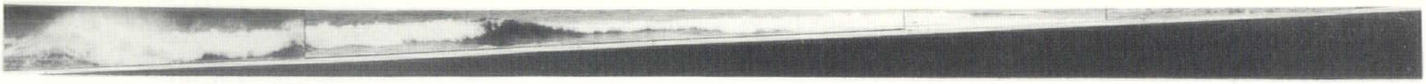

A Quest in Time: Mining the Oceans

This year's AIA National Convention theme focuses on the future. **Hawaii Architect** *asked several scientists and planners to describe research or projects now under way which will impact our future energy, land use, urban planning and environmental problem solving. Their responses show Hawaii is in the forefront of much of the nation's ocean science and alternate energy activities.*

FADS: Fish Aggregating Devices

by **Elizabeth Corbin**
State of Hawaii
Department of Planning
and Economic Development

Floating objects such as logs, seaweed masses, and other debris have been known as excellent concentrators which attract fish such as tuna and mahimahi. Fishermen have increased their catches and reduced their fuel and baitfish costs by taking advantage of the natural inclination of pelagic species to aggregate around floating objects. However, the occurrence of such floating objects is relatively rare around Hawaii. Therefore, the State of Hawaii has attempted to duplicate, and improve upon, this natural phenomenon by deploying anchored fish aggregating devices (FADS) in Island waters to enhance the local fishery.

In 1977, four experimental buoys were deployed in Hawaii waters by the National Marine Fisheries Service. This successful demonstration led to the deployment of 26 stationary buoys by the state in 1980. The first-generation buoys were made from cane-hauler tires with a pole for a light above, and a counterweight below. Design modifications have been made as the buoys have been studied for efficiency and durability. The present design uses several 28-inch-diameter spheres to form a six-foot-diameter base with an eight-foot light pole.

The FADS have proven successful in aggregating many commercially important species. The buoys located farthest offshore in deeper water have been the most successful. To determine optimum placement, studies are underway to obtain data on the relative effectiveness of selected buoys. A predictive model is being developed to determine the potential yield from proposed structures, and related studies are focusing on improved design and the development of specialized fishing techniques. HA

HURL: The Hawaii Undersea Research Laboratory

by **Elizabeth Corbin**
State of Hawaii
Department of Planning
and Economic Development

The Hawaii Undersea Research Laboratory (HURL) is a state program established at the University of Hawaii in 1980. It is supported by the National Oceanic and Atmospheric Administration (NOAA), as part of NOAA's Undersea Research Program. Operations are located at the Makai Research Pier at Makapuu Point, Oahu.

HURL operates the Makali'i, a two-person submersible capable of descending to 1,200 feet where extensive scientific investigations can be conducted. The Makali'i, once called the Star II, had been used by Maui Divers to collect precious coral. It has been refitted with sophisticated instrumentation which measures environmental variables, externally mounted video and still cameras, and a mechani-

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Manganese Nodules

by **Elizabeth Corbin**
State of Hawaii
Department of Planning
and Economic Development

Manganese nodules are found on the deep seabeds of all oceans and in some large lakes and inland seas. They are composed primarily of metal oxides which have slowly formed a crust around some object, such as a shark's tooth or small rock. Roughly spherical, most range in size from peas to potatoes. Metals currently of most interest to mining consortia involved in developing this industry are nickel, copper, cobalt, and manganese. With the exception of copper, the U.S. must now import all almost all of its supply of these metals. Development of a domestic manganese nodule mining and processing industry could ensure a stable supply of these important metals at competitive prices.

The total world resource is not known exactly and estimates of the minable reserves also vary greatly, from 10 billion to 500 billion tons. The mining consortia have already spent over $300 million for exploration and the development of mining and processing techniques. The dollar value of the resource will depend on metal prices at the time of recovery; but, it has been estimated that a single processing plant located in Hawaii could expect annual revenues of up to $770 million (in 1980 dollars).

Hawaii is located very near the richest known deposits of manganese nodules. In 1977, the state began a program in the Department of Planning and Economic Development to investigate the feasibility and potential impacts of a manganese nodule processing industry in Hawaii. It is a state goal to attract a processing industry that will be environmentally sound, socially acceptable, and economically beneficial to the people of Hawaii. Hawaii is included in the site reviews of the four major interested mining consortia, and is consid-

Continued on page 19

A Quest in Time: Alternate Energy Resources

Hawaii Deep Water Electrical Cable

by **Elizabeth Corbin**
State of Hawaii
Department of Planning
and Economic Development

Hawaii depends upon imported petroleum for 90 percent of its energy needs. One of Hawaii's major goals is to become energy self-sufficient.

The Big Island already supplies 50 percent of its electrical energy requirements through biomass conversion and hydroelectric generating sources. Hydroelectric, biomass, direct solar, and wind resources supply 45 percent of the electrical energy demand on Kauai.

A major concern in developing alternate energy resources to their fullest potential is the distribution throughout the state of the power to be produced. Most of the demand for power is on Oahu. Many of the alternate energy resources are on the Neighbor Islands, where demand is much lower. Development of these resources could be hindered unless a viable method of transmitting power to areas of high demand is developed.

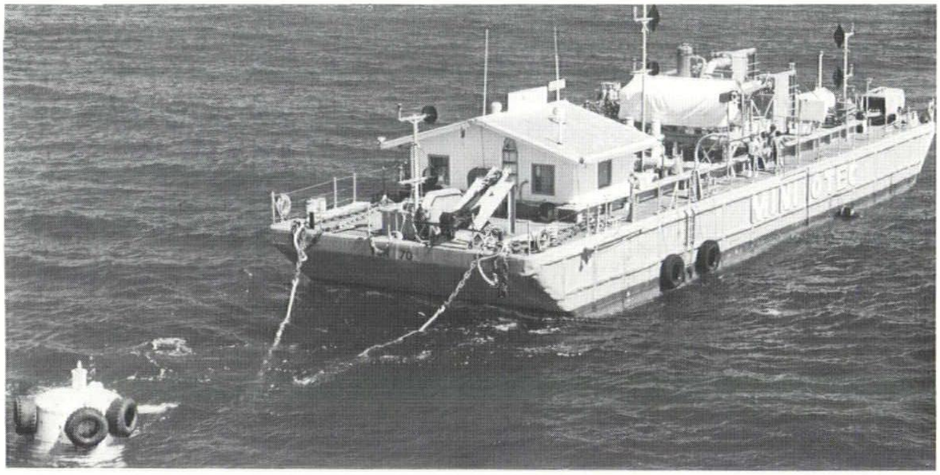
The state has released money to begin preliminary studies of a deep ocean electrical transmission cable system. Hawaiian Electric Company was awarded a $300,000 contract to do preliminary studies, including cost analyses, analysis of route surveys, and development of prototype cable design criteria.

The full program would include manufacturing a special transmission cable, testing the effects of deployment in deep water in the Alenuihaha Channel, and later looping it near the Kahe Point, Oahu, generating station to test the effects of transmitting power. This phase is expected to take four-and-a-half years and cost $17 million.

It would cost $300-400 million to build and install a cable system between the Big Island and Oahu. This system could prompt private industry to spend up to $1.4 billion to develop up to 500 megawatts of generating capacity on the Big Island. HA

OTEC: Clean, Reliable Energy from the Sea

by **Howard Pennington**
State of Hawaii
Department of Planning
and Economic Development



OTEC stands for Ocean Thermal Energy Conversion — a means of generating electricity by using the difference in temperatures of warm surface waters and cold deep waters. It works much like conventional steam-driven generating plants — except that the heat source is warm surface water and the steam-producing fluid is one that boils below the temperature of that water, such as ammonia or freon. The condensing of the vapors after they pass through the turbine-generator is done with the cold water (about 40°F) that is found about half-mile down in all the world's oceans. While OTEC plants are more expensive to build than conventional power plants, they are far cheaper to operate because the fuel — the sun-warmed surface waters — is free.

OTEC is the only form of solar energy that can work night and day, rain or shine, all year round. In addition to supplying power to utility grids, OTEC electricity can be used for energy-intensive processes such as making aluminum or ammonia, the major ingredient in chemical fertilizers. OTEC electricity can also convert water into its components, oxygen and hydrogen. Hydrogen can be used directly as a fuel, or can be used to make synthetic fuels, including gasoline.

The theory of OTEC was first expounded in 1881. The world's first OTEC plant was built in 1930. The first OTEC plant to produce more power than it consumed was Mini-OTEC, built by Lockheed, Dillingham Corp., and the State of Hawaii.

On August 2, 1979, Mini-OTEC began generating electricity with a net output of 10 to 15 KW. It operated for three months, and stimulated worldwide interest in the concept. The world's third OTEC plant was built by Japanese interests on the Pacific island of Nauru. Starting operation in November, 1981, it generates 180 KW, with a net output of 100 kilowatts. The next major step came this year when the Department of Energy awarded two design contracts for 40-megawatt OTEC plants to be located near Oahu's major power plant.

In addition to its other advantages, OTEC is far less environmentally polluting than oil, coal, or nuclear plants. Hawaii's hope is to develop OTEC into the clean and reliable energy source of the future. HA

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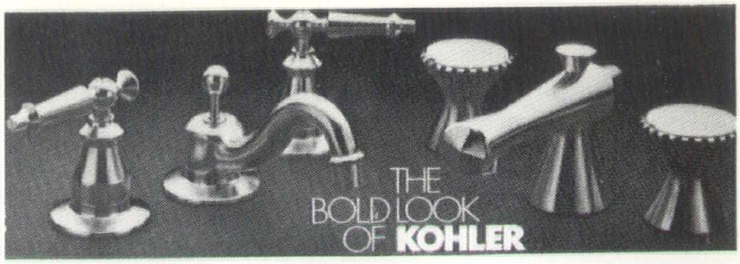

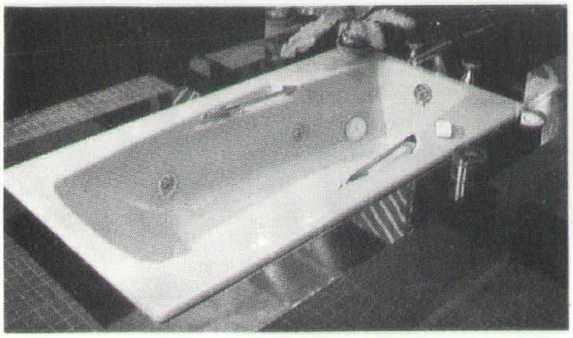

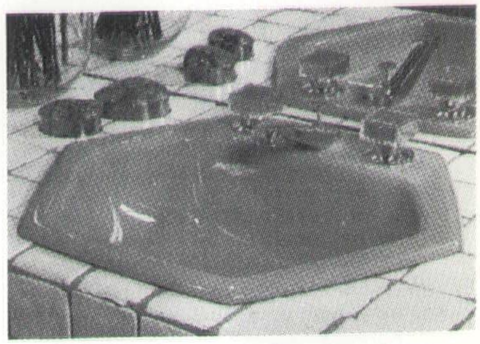

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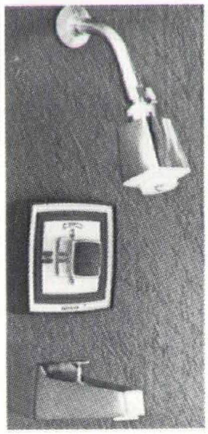

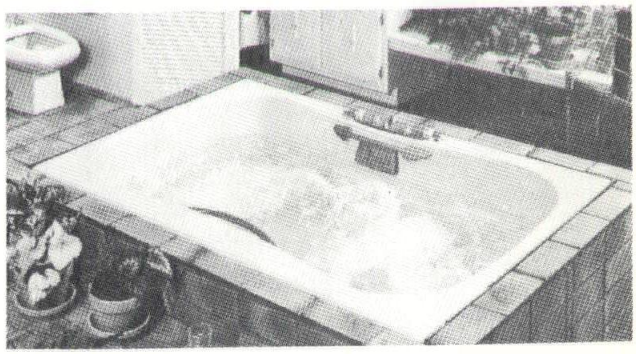

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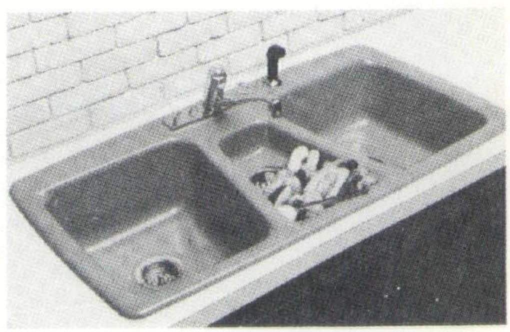

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Photovoltaic Energy Systems

by **Nancy Brown**
Hawaii Natural Energy Institute

Hawaii's most obvious renewable energy resource is the sun. Photovoltaic (PV) energy systems produce direct electrical current from sunlight. Photons of light strike a four-inch-diameter solar cell coated with two wafer-thin layers of semiconductor material, usually silicon, to produce a stream of freed electrons which is drawn off through metal contacts. These solar cells, which generate about 0.5 volts each, are the basic component of two photovoltaic systems now being tested in Hawaii.

In the first, three private residences have been retrofitted with solar panels to produce direct (DC) electricity which is converted by a power conditioner to alternating current (AC). During the day, the electricity produced is used by the household, and any excess is fed into the local utility grid. At night or during cloudy periods the utility supplies electricity to the household. The objectives of this rooftop PV project, funded primarily by the U.S. Department of Energy's MIT Lincoln Laboratory and managed by the Hawaii Natural Energy Institute, are first, to demonstrate that PV systems can supply typical household electrical needs and second, to resolve technical environmental or social issues associated with PV systems.

G.N. Wilcox Memorial Hospital on Kauai is the site of a second though different PV demonstration

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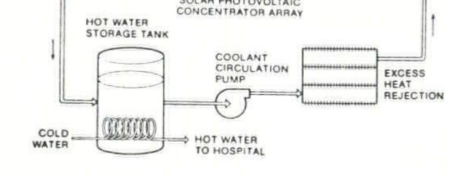
System Schematic



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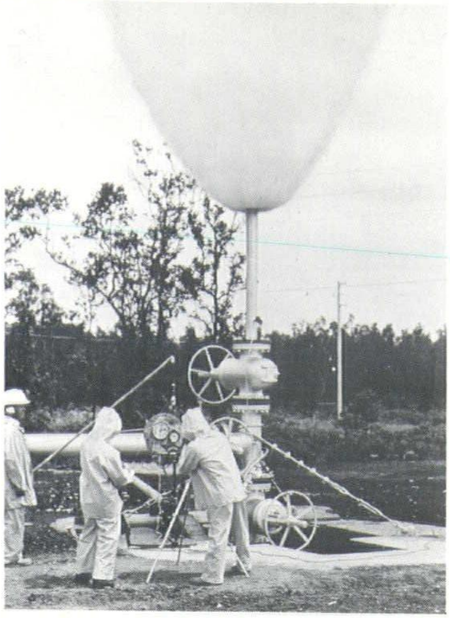


Geothermal Energy for Hawaii

by **Jim Woodruff**
Alternate Energy Analyst, State of Hawaii Department of Planning and Economic Development

Imported oil costs Hawaii's people more than $1.5 billion annually. Indigenous, renewable, essentially inexhaustible alternate energy resources are now being developed to achieve energy self-sufficiency. One of the most promising is geothermal energy-controlled heat from volcanic activity — which has an advantage over most other forms of alternate energy because it is a constant, reliable source of "baseload" power.

The roar of steam from the first successful geothermal well in Hawaii in 1976 generated intense interest in commercial development of this resource. A demonstration electrical power plant powered by this well has been built in the Puna District of the Island of Hawaii. The plant produces enough electricity for 1,000 families. (Hawaii is the second state with on-line electric power from geothermal steam; California was first.) The successful operation of this plant, built with federal, state and county grants, encouraged private energy developers to take up the search for natural steam.

Three companies exploring the Kilauea volcanic rift hope to tap

Continued on page 19

Biomass Energy

by **Nancy Brown**
Hawaii Natural Energy Institute

Biomass, which includes organic matter such as agricultural crops, grasses, trees, algae, and animal wastes, is a versatile energy resource. Currently, it is the only renewable energy resource contributing substantially to the reduction of Hawaii's petroleum dependence: sugar cane bagasse burned in sugar mill boilers provides nearly eight percent of the state's total energy needs. Biomass also has the greatest potential of any of the renewable resources for liquid fuel production, which is an attractive option since 55 percent of Hawaii's energy needs are for liquid transportation fuel.

Several processes can be used to convert biomass to usable power, either electrical or nonelectrical. Direct combustion of cane or pineapple waste, hay, wood chips, macadamia nut shells, and urban waste produces electricity or process heat. Molokai Electric is presently installing a 3.3-MW biomass boiler for which Molokai Ranch will supply 17,000 tons of hay a year. Honolulu's Program of Waste Energy Recovery, H-POWER, could replace 500,000 barrels of oil a year, dispose of urban waste, and reduce landfill requirements.

Biochemical processes can also be used to convert biomass to gas and liquid fuels. Efficient systems for anaerobic digestion, which produces methane gas from animal or crop wastes, are presently being developed on several swine and poultry farms in the state. A small part of Hawaii's approximately 320,000 tons of sugar cane molasses is now being converted to alcohol by fermentation. Ethanol from this feedstock or from pineapple juice, could be used in gasohol for internal combustion engines or in vehicles modified to operate on alcohol fuel.

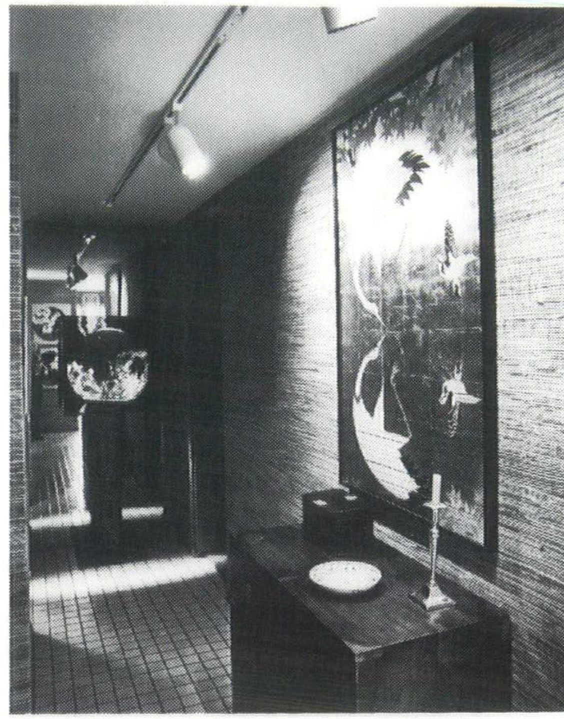
Pyrolysis is a third process for extracting usable energy from biomass. Since August 1980, Pacific Resources, Inc. (PRI), the Hawaii Natural Energy Institute (HNEI), and the Institute of Gas Technology

Continued on page 28

Apartment Becomes "Lanai in the Sky". . .
CERAMIC TILE THROUGHOUT— AND SMALL APPEARS LARGE

INTERIOR DESIGN BY:
Lowell B. Barnhart ASID
Philpotts Barnhart & Assoc.
Brian J. Shuckburgh ASID
Contract Commercial Interiors Ltd.

Pegge Hopper Art, Ceiling Fan



James Raker Painting, Single Candlestick

Hawaii's tropical outdoors seemingly comes inside, saying aloha to visitors to this beautiful Victoria Street apartment of interior designers Lowell Barnhart and Brian Shuckburgh. Small white Ceramic Tile flooring throughout plus counter tops and mirrors achieve the outdoor feeling of this "lanai in the sky." One more tribute certainly to the versatility of beautiful, long lasting, easy care Ceramic Tile—fitting so well with Hawaii's easy, gracious life style. Note in the photos how two professional designers team in creating this gem.

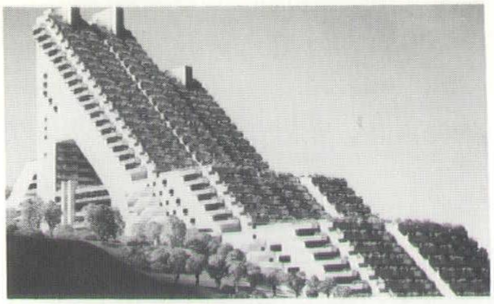
HAWAII CERAMIC TILE, MARBLE & TERRAZZO PROMOTION PROGRAM
615 Piikoi, Suite 804, Honolulu, Hawaii 96814: Att'n: John P. Brack
Tel. 526-0469. Ask for "Tile"

Contact anyone of these Promotion Program participants:

A-1 Tile Corp. 845-9945
Allied Floor Corp. 847-0288
Atlas Tile Inc. 839-7403
Bob Pezzani Ceramic Tile 261-1580
Classic Tile Corp. 841-6893
Leo Cecchetto, Inc. 848-2428
Hawaii Tile and Marble 839-5102
Honolulu Roofing Co. Ltd. 941-4451
S. Kunishige Tile 734-3340
Logan Tile Co. 262-5724
Nan-Cor Tile Company 488-5591
Pacific Terrazzo & Tile Corp. 671-4056
Pacific Tile Co., Inc. 841-8534
Tidy Tile 833-3042
Venture Marble, Inc. 847-2105
W.F. Pence, Kailua-Kona 324-1600
Wichert Tile Ltd. 955-6631

SMILE! IT'S CERAMIC TILE

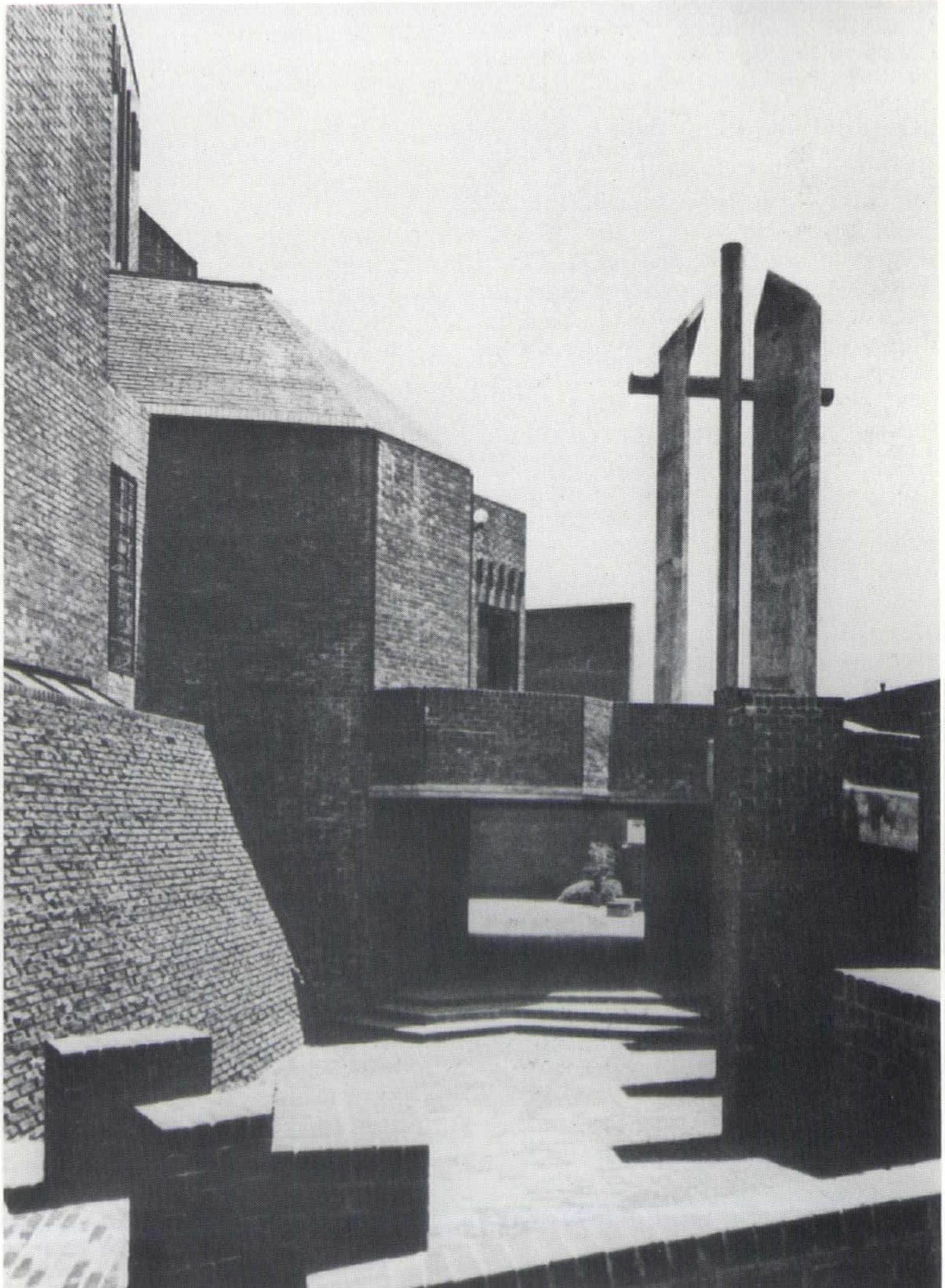
Ceramic Tile, Marble & Terrazzo Belong in Hawaii



KIM SWOO GEUN, FAIA

by Gerald Allison, FAIA

Above left: Alborg, Tehran 1976. Right: Kim Swoo Geun. Below: Masan Cathedral 1979.



Kim Swoo Geun, in 1982 undeniably Korea's leading architect, was a 1970 recipient of Hawaii Society/AIA's Pan Pacific Award.

Initiated in 1957, the award was conceived as a way to recognize Pacific Basin architects producing outstanding architectural design work but not yet recognized internationally. Among those who were honored early in their careers by HS/AIA's Pan Pacific Award are Japan's Kenzo Tange and Kiyonori Kikutake, Leandro Locsin of the Philippines, and Arthur Erickson of Canada.

Kim Swoo Geun is another.

In recognition of his excellence in design, he will recieve an honorary fellowship in the AIA at the investiture of fellows during the AIA national convention in Hawaii. Seven of 15 past Pan Pacific awardees have been thus honored.

At home in Seoul, Korea, Kim Swoo Geun heads a rather unique architectural/business establishment. His spatially interesting multi-level professional office is housed within his own building, which also includes a performing arts theatre, a gift shop featuring products designed by his firm, a book store, and a coffee shop—all owned and managed by his company. The firm also publishes a monthly art and architecture magazine entitled **Space.**

Since receiving the Pan Pacific Award in 1970, Kim has produced a wealth of outstanding architectural designs throughout his country and the world. The Hawaii Society extends congratulations to architect Kim Swoo Geun for his contribution to architecture and for receiving Honorary Fellowship in the American Institute of Architects.

HA

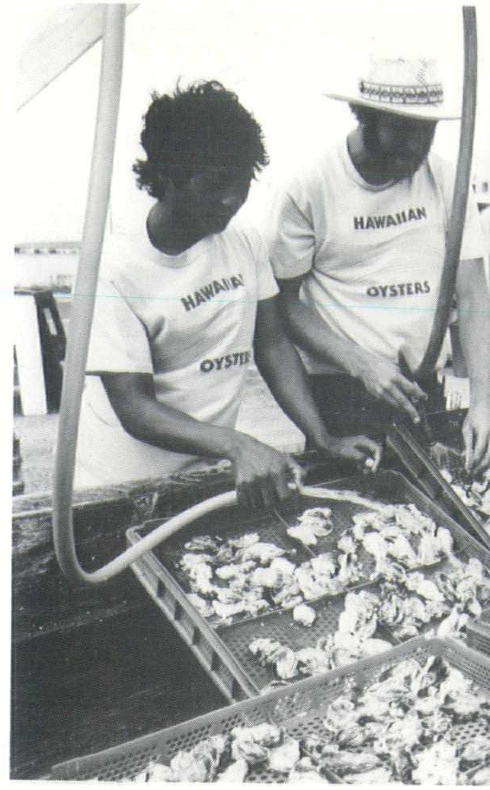
Aquaculture in Hawaii Steel Plows and Plankton

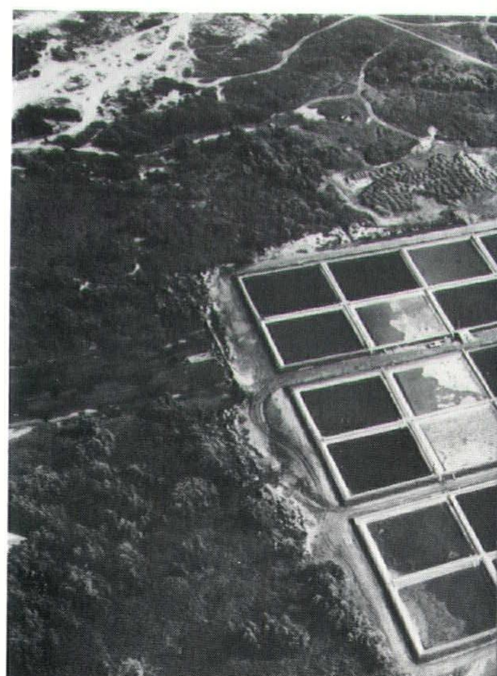
by Taylor A. Pryor

Taylor A. "Tap" Pryor has been a resident of Hawaii for 25 years. He spent his first two years here flying helicopters for the Marine Corps and then was a graduate student in marine biology at the University of Hawaii until 1961 when he dropped out in order to design, build, and operate Sea Life Park. He was president of Sea Life Incorporated until 1970. During this time he also founded the Oceanic Institute, which is today partly endowed by revenues from the exhibit.

From 1966-1968, he was a state senator and chairman of the Senate Committee for Agriculture, Forestry, and Conservation. He was a member of former President Johnson's Commission on Ocean Science, Ocean Engineering, and Ocean Resources. Pryor is a consultant to the United Nations Environmental Program. He served from 1966 until recently as a member of the Governor's Advisory Committee on Science and Technology for the state of Hawaii.

In 1972 he designed a commercial lobster farm for French Polynesia and in early 1973 conceived the Systemculture plan of fully controlled on-land seafood production. In late 1973, he tested his ideas with plankton, oysters, and seaweed in model facilities at Makapuu Point. He built Oahu Oyster Farm in 1974, and in 1975 he financed and initiated construction of The Kahuku Seafood Plantation. Pryor is president of the operating company, Systemculture Corporation, and the general partner of the investment partnership.





Aquaculture will be Hawaii's next major industry.

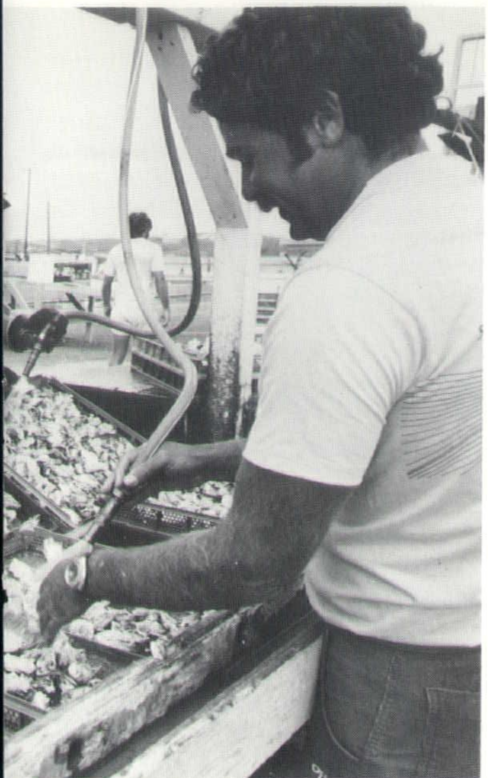
Why is aquaculture next? This town doesn't quite realize it yet but aquatic production and Hawaii are ideally suited for each other. The community offers the perfect infrastructure to support the high technology, entrepreneural, capital-intensive operations which grow and harvest export-oriented, high-value seafood. Do I have to describe the vital infrastructure? It's everything in sight: construction companies, mechanical skills, willing and educated employees, suppliers of such things as liquid fertilizer, a reliable electric power grid, good air cargo, communications, residential opportunity, a supportive university, available land, and at least one innovative financial institution.

In addition to this nuts and bolts support, which you might fully appreciate only when you examine other aquaculture sites elsewhere, we are blessed with certain natural resources because we are tropical: warm sea water necessary for rapid growth, trade winds for wind power, and good solar conditions necessary to grow the phyto-planktonic feed which will someday become basic to all aquatic animal husbandry.

Granted all of the above elements, aquaculture will grow in just 12 years to a billion dollar export industry. Throughout 1983 my farm alone will harvest 200 tons of seafood per acre of plankton water. We are presently air shipping over 200,000 oysters a month to distributors in Los Angeles, New York, and Amsterdam. Our oyster seed stock is bred on Oahu in a sophisticated but home-built hatchery. Soon we'll expand that part of the operation to provide seed stock for abalone, lobster, clams, and scallops. Some day we'll try crab, fish, shrimp, mussels, and turtle. The raceways and reservoirs are on land, out of the ocean. They represent fully controlled aquatic seafood factories.

The operation is quite simple. We pump sea water up from wells, adding liquid fertilizer to the water on its way to the reservoirs where single-cell plants, phyto-plankton, grow in astronomical numbers and are harvested continually to feed the oysters kept in separate tanks. The oysters grow to market size in only nine months, compared to three to five years in nature. They are fed under ideal conditions at all times until they are ready for market. We call them the world's most pampered oysters.

The oyster waste water goes into ditches where seaweed grows profusely on its fertilizer values; the seaweed is then used to feed abalone. Any excess plankton is shunted off before it goes to the



oysters and is then filtered, dryed, and stored in a silo. When we have a lobster hatchery at Kahuku, we'll feed them the stored plankton in a pelletized form.

Lobster, abalone, and oysters, and some day all of the rest, are kept in identical raceway tanks. In other words, we have a uniform design for growing almost any kind of seafood. It is wholly integrated at one location and can be energized largely by tropical power. It turns out an enormous tonnage per acre. It operates continuously without seasonal interruptions. Its product, properly chilled, can be air shipped live to markets anywhere. Clearly it's the beginning of a big industry with access to an unlimited market.

The world harvest of seafood has remained flat at 50 million tons for the last five years. In fact the major stocks of all of our favorite seafoods have declined, but trash fish have made up the losses. In just five years the demand for seafood has shot up and surely will keep doing so for the few remaining years of this century, a short period during which time the world population will double while terrestrial agriculture will also remain nearly flat. It seems to me that only aquatic production, utilizing sea water, can make up the difference between supply and demand.

What will be the size of the market? Twenty-five million tons? Surely not less. What will the dollar volume be? Well, presently, oysters shipped from Honolulu to Amsterdam command $5,000 per ton. Let's say that all of the potential crops mentioned above could command only 20 percent of that price. Even so my calculator runs out of zeros. Get out the pencil and it totals $25 billion. Cut that in half and then halve it again and you still come up with an industry size that would boom the entire Pacific basin economy.

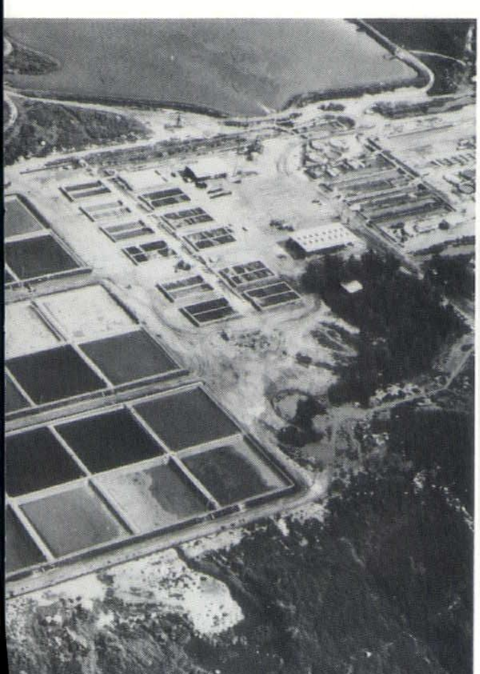
Even these projections don't tell the whole story. Supposing we took not just the excess plankton but all of it from our reservoirs to store as powder in silos. About half of that bulk would be protein. We are, in fact, presently capable of getting 50 times more protein from our plankton reservoirs than anyone can get from a similar-sized cornfield. While most humans don't eat plankton, their cattle, swine, and poultry would. What if we were to take 1,000 acres of abandoned sugar land and convert it into a plankton protein refinery? We could produce 200,000 tons of pure protein per year. That's *another* industry but this time with a terrific multiplier effect. Since it's the cost of animal feed that runs up the cost of our food, what effect would it have on all of us if protein plankton could substantially bring that cost down?

The projected growth over the coming 12 years to exceed the billion dollar mark in Hawaii won't be on a straight line but a curve. A $100 million investment over the next several years would yield only half that amount in revenue by 1986. However, if that kind of investment in production were to be doubled each three years until nine years had passed, Hawaii would be on target. Such growth is not only possible but certain once just one of the first farms becomes profitable and then goes public.

Because bankers are forced by their own regulations and guidelines to hold back when something new is happening, aquatic entrepreneurs will first have to turn to publicly financed equity to supply their capital-intensive needs. Major public issues, underwrittem by responsible firms, can be anticipated in 1983 and 1984. Even then the growth curve for production will go fairly gently upward. However, when those publicly owned farms become profitable, it will be bandwagon time. Watch the action then as the venture capitalists, the banks, and the industrial biggies all discover aquaculture.

My hope is that the Pacific Island communities including Hawaii can all be well-positioned by that time, that each will have a master plan on how to proceed and at least a few trained people prepared to lead the way. Many years ago, the Middle West and the Crimea were open prairies. Then one day a man named John Deere, who was making plows, switched from iron to steel. The steel cut well and didn't clod. Soon the millions of acres of prairie became the grain baskets of the modern world. Now we have not plows but plankton as our newest tool. Will the Pacific Island nations become the world's seafood basket? Why not! HA

Left: Taylor A. "Tap" Pryor.
Below: Kahuku Seafood Plantation, Phase II; engineering design by Belt, Collins & Associates.



Photovoltaic
Continued from page 12

funded by U.S. DOE. This solar energy system consists of 80 concentrating parabolic collectors which track the sun and focus all available sunlight on PV cells mounted at the troughs' focus on narrow rods (see figure). Water flowing through these rods cools the cells to maintain an effective operating temperature and, at the same time, recaptures some of the system's 2.5 million BTUs of thermal energy per day in order to meet most of the hospital's hot water needs. The 35 KW of direct current electricity which the system optimally produces are transformed to alternating current by a power conditioning system which feeds electricity into the hospital's electrical network in parallel with that from the local utility.

While photovoltaic systems are not yet free of technical problems, they hold great near-term promise as a source of clean, noiseless, renewable energy. HA

HURL
Continued from page 9

cal arm which can be manipulated to examine and collect samples.

A unique system utilizing a launch, recovery, and transport (LRT) platform allows the Makali'i to be submerged to a depth below wave action, where it is released by scuba divers and proceeds on its mission. The reverse procedure is used at the end of the dive.

The first mission of the newly outfitted and certified Makali'i was an expedition to Eniwetak Atoll in the Marshall Islands during the summer of 1981. Research was conducted on bottom-sediment effects of residual radioactivity from nuclear testing on the atoll, fishery potentials, and the geology of atoll formation.

This year the Makali'i has been used to explore the Puna Canyon and search for geothermal vents off the Big Island; study the operations and effects of the sewer outfall off Sand Island; and collect rare deep-water organisms for testing as possible sources of antibiotics.

For the first time, engineers have been able to see exactly how the Sand Island sewer pipe functions in situ and how it affects the environment. And several new species of mollusks have been discovered. HA

Geothermal
Continued from page 12

natural boilers more than a mile below the surface and use the steam to generate electricty and for other industrial applications. A University of Hawaii scientific team assessing statewide resources has identified 20 potential geothermal sites on various islands. Since deep exploratory drilling costs may be as much as $2 million per well, exploration is now concentrated in the Puna District, the most promising area.

Contracts are being considered between the Hawaii Electric Light Company and the energy developers to supply future electrical needs of the Big Island.

On Oahu, where more than 80 percent of the state's electricity is consumed, the Hawaiian Electric Company is leading a study of the feasibility of undersea electric power cables to connect Oahu with future Big Island geothermal plants. One-third of the state's electrical needs could be supplied by geothermal energy by the year 2000.

Properly developed and wisely used, geothermal energy can be a powerful economic and social asset for Hawaii's people and Hawaii's future. HA

Nodules
Continued from page 9

ered a prime contender as a processing site by two of them.

Impact assessments being conducted now are focusing on potential environmental effects. Probably the most serious environmental consideration that will be faced by a processing industry is the disposal of tailings — the residue from the processed nodules. Three alternatives — ocean disposal, land disposal, and some form of beneficial use of the tailings — are being studied.

But the future of the manganese nodule mining industry is not certain, because most of the world's resources are located beyond the 200-mile exclusive economic zones. How these resources are to be managed is a controversial issue still being debated at the United Nations Conference on the Law of the Sea. Several countries, including the U.S., have passed interim legislation to allow development of the industry while an agreement is being negotiated. HA

Accretion: Growing Architecture in the Ocean

by Wolf H. Hilbertz, AIOA
President
The Marine Resources Company

Wolf H. Hilbertz is a German-born architect and former University of Texas professor. Parts of the work described in this article were funded by the U.S. National Sea Grant Program, the U.S. National Endowment for the Arts, the Marine Science Institute of the University of Texas at Austin, the Texas Coastal and Marine Council, The Marine Resources Company, and the author. Individuals requiring more scientific and engineering information on the mineral accretion process should contact Hilbertz at The Marine Resources Company, 819 Ball Avenue, Galveston, Texas 77550.

I never had the opportunity to discuss post-modernism in underwater architecture. This is not because air is expensive in this environment; rather, I never met a fellow architect working there. Instead, I met scores of engineers, artists, and scientists.

Why are architects ignoring the seven-tenths of the earth's surface covered by the seven seas? I have many suspicions and no answers, but sincerely hope that the profession will finally recognize and seize the many creative and awarding opportunities connected with building in the ocean, with its ecology, and with a view to its productivity.

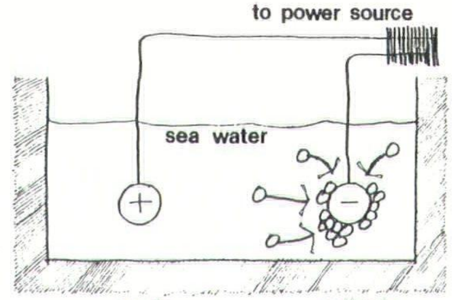
Have you ever picked up a shell at the beach and wondered how it was assembled, how its shape came about? Or pondered corals, constantly rebuilding the Great Australian Barrier Reef, the largest built structure on earth? Builders in the sea utilize the energy and materials surrounding them. Coralline algae, for example, have a layer of negatively charged material outside of their cell walls which attracts positively charged calcium carbonate ions naturally present in sea water, thus building their "houses."

Mineral accretion is a similar although less refined process: An electrically conductive material like mesh, expanded metal, rebars, mercury, or carbon fibers is connected to the negative pole of a direct current power supply, making it a cathode, and placed in sea water. One or several smaller pieces of graphite or carbon, connected to the positive terminal, the anodes, are placed in the vicinity (see figure). Now we have a galvanic cell in the electrolyte sea water, accreting or precipitating positively charged calcium carbonate and magnesium hydroxide ions at the cathode, growing architecture on a framework which can have any configuration.

Technical Data

Now, let's turn to some technical information. Accrete has a com-

HILBERTZ



anode cathode

pressive strength of 4,260 psi. We hope to increase this value to around 12,000 psi in the near future.

Electrical power expenditure is about one kilowatt hour per pound of accreted mass, depending upon various parameters. We have been successfully using electricity generated with photovoltaic cells and wind-driven generators. In these cases on-site energy organizes on-site materials for useful structures.

Our typical use of electricity ranges from two to 16 volts, and three to 300 milli amperes per square foot area of cathodic material. The current density (amperes) determines the rate of accretion, consequently we keep the voltage down to the minimum to optimize electrical power input. Slow accretion, taking several months, yields a harder material than fast growth. The settling of marine organisms in and on the accrete, normally referred to as biofouling, is actually a benefiting process, delivering free-of-charge materials.

Projects and Uses

We have been building artificial reefs, breakwater components, boat hulls, building components, sculptures and other art pieces, and countless experimental devices.

We solidified volumes of beach aggregate and mineralized wood in sea water, which is done by placing nails or spikes in the wood and connecting these to negative DC terminals. The resulting combination of wood fibers and minerals does not normally occur in nature. It is hypothesized that therefore no natural enemies exist to attack this "rockwood." Similar results can be achieved by wrapping a mesh or hardware cloth around wooden structures such as pilings and accreting a protective layer, partially mineralizing the wood. Marine archaeologists tell me that preserved wood from ancient shipwrecks is mineralized and found around metal spikes or fasteners in planks, where an electrical potential exists because of the presence of dissimilar metals in the surrounding water.

Reinforced concrete in sea water, once fissured or broken, can be repaired by using the rebars as a cathode, closing the cracks with accrete, thereby restoring structural strength and affording corrosion protection.

Near the Cayman Islands we accreted test samples at a depth of more than 3,000 feet, achieving the same results as in surface water.

The mineral accretion process has a unique quality: Should an accretion structure be damaged, it can easily be repaired by applying electricity again. At the broken area electrical resistivity is lower than in undamaged areas, and preferential accretion occurs there. This bears a striking resemblance to emerging bone fracture healing techniques using electrical current.

The Future

On the drawing board now are cold water pipes for Ocean Thermal Energy Conversion (OTEC) plants. These ducts will have diameters of 30 to 300 feet, lengths of 5,000 to 15,000 feet, and will be bottom-mounted.

We are planning islands for industry and recreation, barges, pipelines for fresh water transport, pipeline protection mats, scouring mats, protective renewable skins for islands constructed of dredged materials, aquaculture facilities, marinas, storage tanks, dams and jetties, current diverters, facilities to harness the energy of ocean cur-

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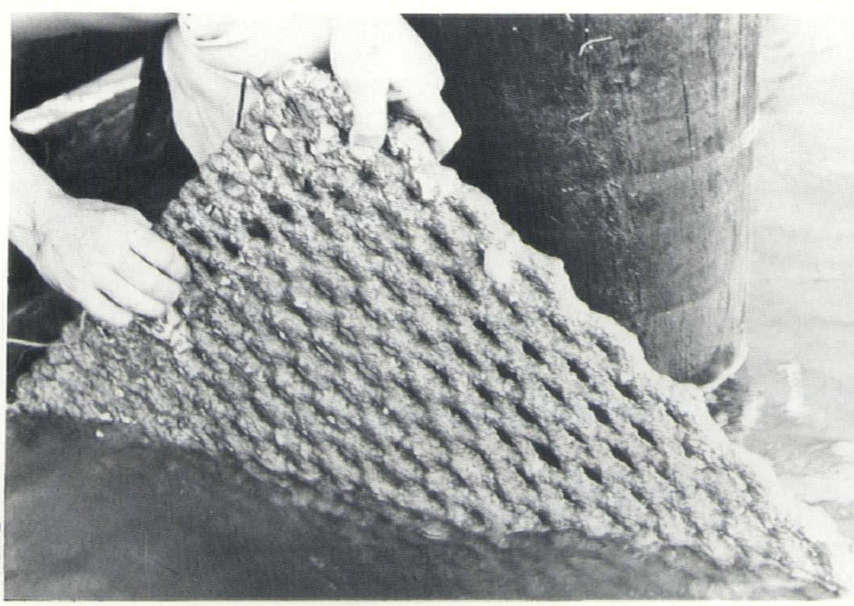


HILBERTZ

Above: An accreting piece of expanded metal.
Right: Double shield component.

Far left: Conceptual drawing, small grown island.
Near left above: Deposition of minerals.
Near left below: Wolf H. Hilbertz.

HILBERTZ

HS/AIA 1982 Awards Program

Jury members for Honor Awards and Citations were Charles R. Sutton, FAIA; Lewis Ingleson, AIA; Wesley Yoshikawa, AIA; Gordon Tyau, AIA; and Lee Coleman, ASC/AIA. Featured on the following pages are the four projects that won Citation awards. Honor Award and Civic Enrichment award winners will appear in future issues of ***Hawaii Architect.***

Summary of Jury Comments

by CHARLES R. SUTTON, FAIA

The jury received 50 submissions of some of the best recent work in Hawaii and projects by Hawaii architects in Oregon, Minneapolis, Singapore, and Malaysia. Honor Awards and Citations were given in recognition of outstanding work for "Excellence in Architecture" and "Excellence in Architecture Involving Extended Use." The jury met on two occasions several days apart.

I can say that there was unanimity in recognition of those projects awarded and much discussion and differing views on those not awarded. Many projects were well-designed, served their purpose well, some with exceptional characteristics and qualities in part, but those awarded demonstrated that "extraordinary achievement" in architecture that makes the difference that deserves special attention.

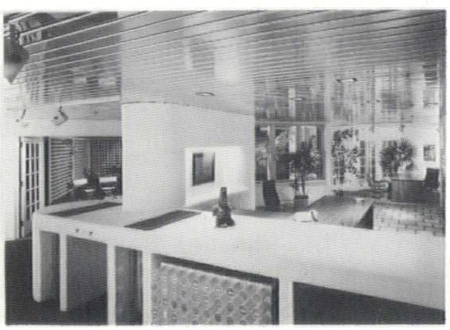
The work submitted ran through many building types from individual residences to office buildings, hotels, and recreation buildings. Several entries were interior design projects primarily, or the submittal emphasized the interior solution. This was considered a valid architectural submittal and influenced the award or non-award in some cases. Only three public buildings were submitted and two were in the category of extended use restoration or renovation projects. Housing projects of large scale are notably absent from the submittals but one resort-type housing project was awarded and another small luxury project given a great deal of consideration.

"Excellence in Architecture" was the basis of selection. Problem solving, contextualism, regionalism, and even morality were subjects of discussion, argument, and questioning, but in the end the question of quality of architecture prevailed.

By the end of the jury meetings, we agreed that more critical discussion of projects among architects in practice — not judges vs. judged but an exchange of ideas and opinions regarding the issues with which our profession works — would be healthy, probably enjoyable, and certainly beneficial to all of us. HA

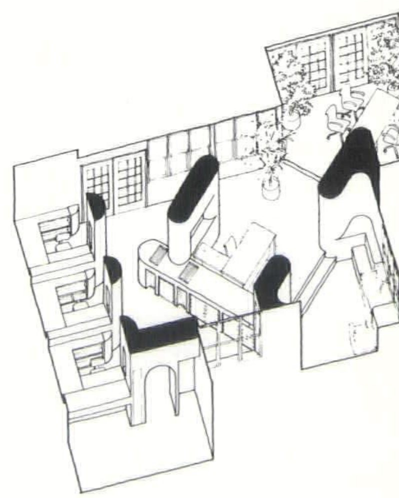
THOMAS

HS/AIA 1982 Awards Program
Offices of Heneghan & Leucht Architects, Inc.
Excellence in Architecture Citation



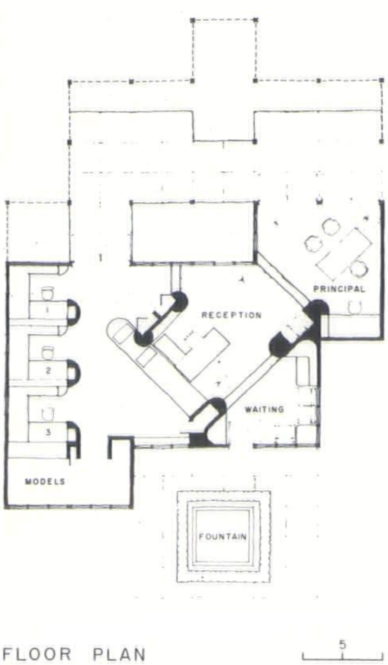
THOMAS

Location: Hualalai Professional Center, Kailua-Kona, Hawaii
Architect: Heneghan & Leucht Architects, Inc.
Contractor: Lathrop Construction Co.



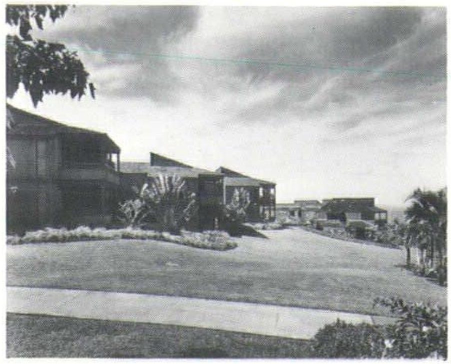
Located on the garden level in the Hualalai Professional Center, the waiting and reception areas are exposed to public view. Rough curvilinear plaster walls form art niches oriented to the visitor and control views to interior work areas. A highly reflective aluminum ceiling and the tile floor pattern reinforce the diagonal office layout. Curved wall forms define work spaces and are fitted with custom teak cabinetry.

The open inner office enhances communication between the three drafting stations and the principal's office separated by the raised receptionist's area. Ceiling fans supplement the natural ventilation provided by double doors and windows which open onto a private garden terrace.



FLOOR PLAN

HS/AIA 1982 Awards Program
Wailea Ekolu Village
Excellence in Architecture Citation
Johnson Reese Luersen Lowrey Architects, Inc.


SALBOSA


SITE PLAN

Location: Wailea, Maui
Architect: Johnson Reese Luersen Lowrey Architects, Inc.
Contractor: Rovens-Coastal Joint Venture
Bid Date: 1978

Structures are placed in a horizontally staggered and vertically layered pattern on the sloping site to maximize long-range views. The structures are consolidated to provide a greater amount of contiguous open space.

Site Size: 17.6 acres
Density: 149 units at 8.4 units/acre
Buildings and Structures Gross Square Footage: 204,400 square feet


TYPICAL GROUND FLOOR PLAN


SALBOSA

HS/AIA 1982 Awards Program
Arizona Memorial Visitors Center
Excellence in Architecture Citation
Chapman Cobeen Desai Sakata, Inc.

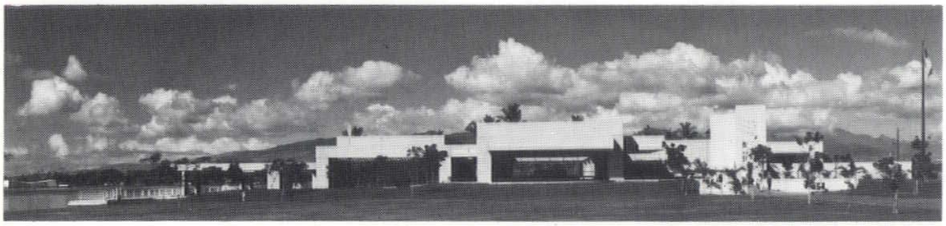
This shoreside facility is designed to receive and prepare visitors for their trip to the U.S.S. Arizona Memorial. The building design is a grouping of individual structures around a central landscaped courtyard and is tied together with covered walks and trellis work.

The poor subsoil conditions encountered on this site have dictated a structural system that will accommodate future jacking and releveling of the building complex. A suspended slab on short piers with pad footings poured on grade places only the relatively light building load on the site and also provides a crawl space for workers to mechanically jack the building.

Location:	Pearl Harbor, Oahu
Architect:	Chapman Cobeen Desai Sakata, Inc.
Contractor:	S&M Sakamoto, Inc.
Bid Date:	1978
Construction Period:	1978-1980

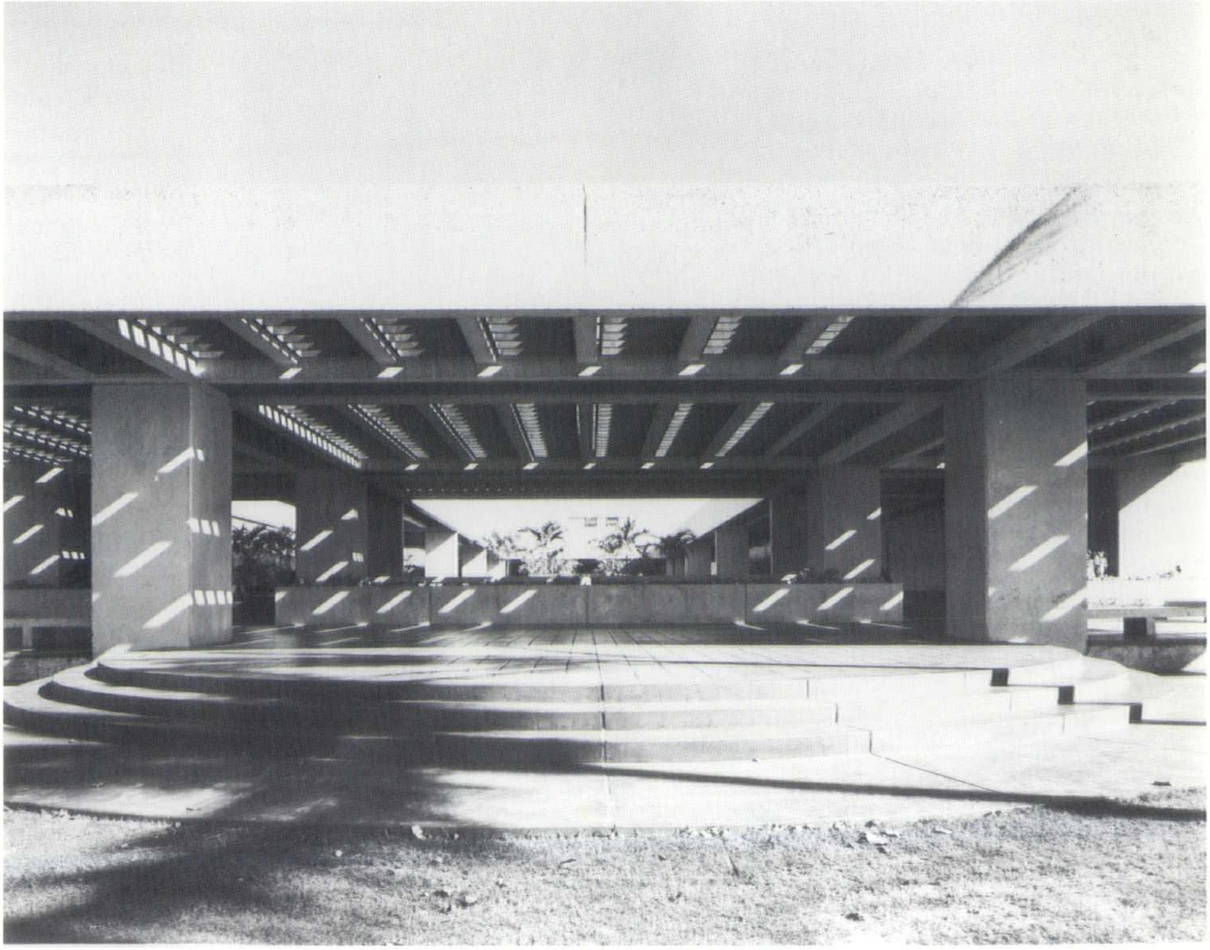
Cost:

Architectural:	$1,495,898
Structural:	2,027,292
Mechanical:	269,431
Electrical:	132,186
Total Construction Cost:	4,527,428

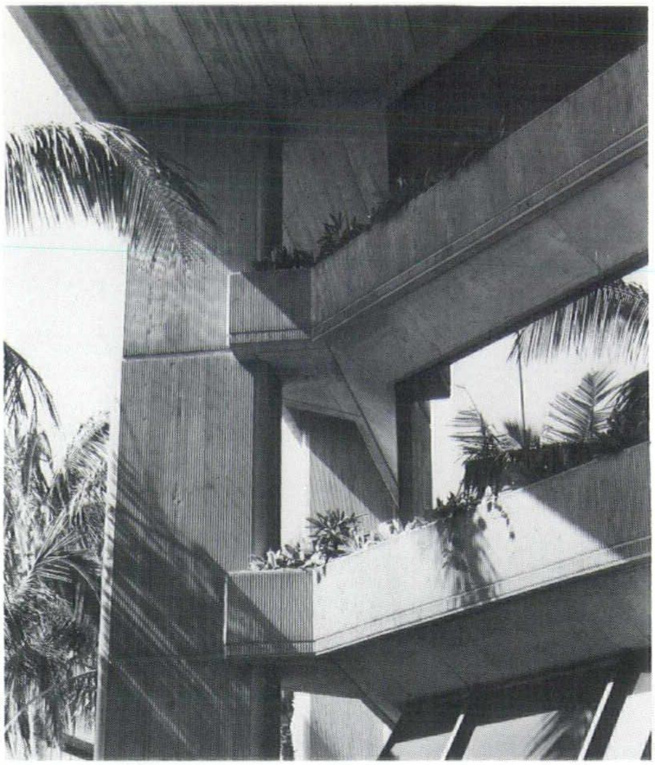


FRANZEN

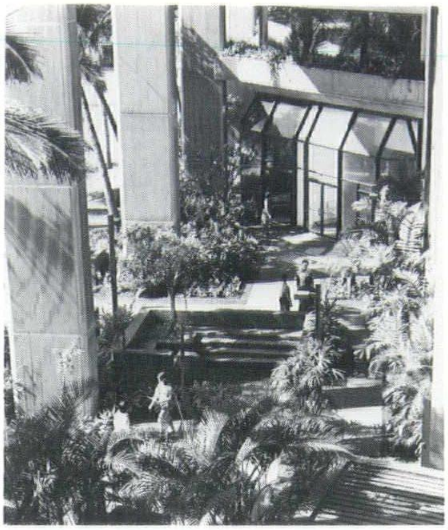
FRANZEN



FRANZEN



FRANZEN

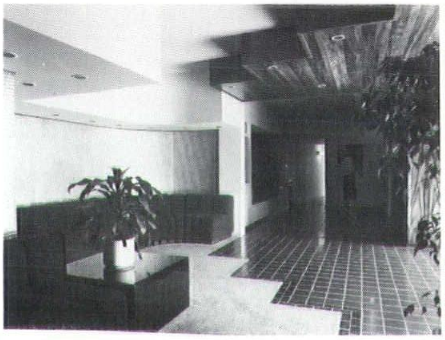


FRANZEN

HS/AIA 1982 Awards Program
The Hasegawa Komuten Building
Excellence in Architecture Citation
The CJS Group-Architects, Ltd.

Location: 820 Mililani Street, Honolulu
Architect: The CJS Group-Architects, Ltd.
Contractor: Pacific Construction Co., Inc.

Development of the site had to conform to Capital District open space requirements (50 percent), height restrictions (maximum 100 feet), and Ewa and mauka property line setback requirements. The design solution was to cantilever the building over landscaped open space. A special aluminum extruded window frame was designed, hiding vertical mullions and allowing bronze reflective glass to read as a continuous band. The building is one of the first major commercial buildings in Hawaii to adhere to new energy conservation laws.



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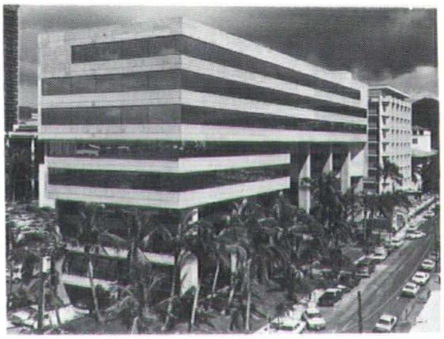

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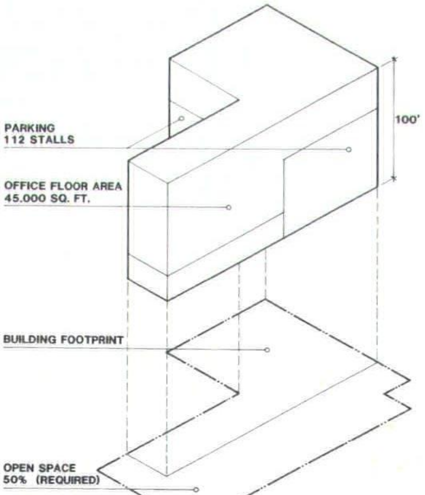
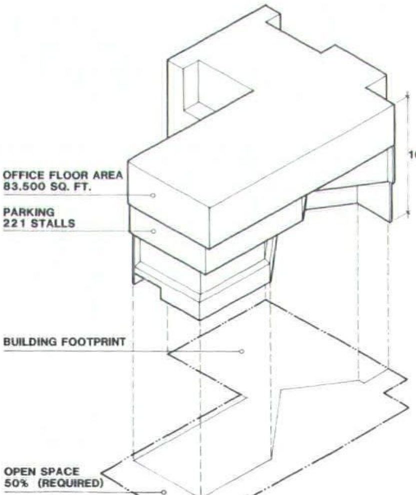


CONVENTIONAL APPROACH
Yields Insufficient Floor Area and Parking



AS-BUILT SOLUTION
Maximizes Floor Area and Parking

New Members

NANCY GOESSLING our newest Student Affiliate member, is a fourth year architecture student at the University of Hawaii, and will serve as president of the Student Chapter, HS/AIA next year. Active and enthusiastic, she is also a member of the ODC Planning Committee and the Junior League of Honolulu. She hails from St. Louis, but has lived in Hawaii with her husband and daughter for seven years. She believes her first degree, a B.A. Sociology (Washington University), will help her greatly in her architectural career.

RON WADE, AIA, first worked for Sam Chang Architect & Associates in its Tehran office. When that office closed, he joined the Honolulu office, where he has worked for three years. He is originally from Phoenix and received his B. Arch from Arizona State University in 1973. He has travelled extensively through Europe, the Middle East, India, and Thailand. His special interests are photography, water sports, and racquetball. HA

Biomass
Continued from page 12

(IGT) have been evaluating a HYFLEX™ hydropyrolysis method which heats biomass in a hydrogen-rich atmosphere to produce LPG, oil, and char. By controlling reaction time and temperature, this product slate can be varied according to market and energy needs.

Biomass, presently Hawaii's major renewable energy resource, should become increasingly important in contributing to the state's energy future, both as boiler fuel and as feedstock for liquid fuels. HA

Accretion
Continued from page 21

rents, floating habitats, and more.

The legislature of the State of Louisiana recently appropriated substantial funds to demonstrate shore erosion control devices using the mineral accretion process.

We are investigating processes of decretion, or mineral dissolution, which can be performed selectively. If growth and removal of accrete can be controlled, we add the very important quality of plasticity to environments which are grown, maintained, reinforced, altered, and eventually reclaimed electrically. We are not envisioning an updated one-way architecture, but an architecture which is capable of a dynamic evolutionary existence. To illustrate this postulate, let us briefly consider the structural adaptability of the mammalian bone system: tiny crystals, embedded in the bone matrix, produce an electrical potential, the piezoelectric effect, when loads act upon the system. These potentials guide the deposition of bone matter to the sites where it is needed in structural terms. If we cut bone sections and overlay these with isostatic lines, it is quite evident that bone matter is assembled right along these lines of compression, stress, and tension. Furthermore, different material combinations are used for a variety of functions.

If we did not have the piezoelectric effect in accrete, it would be simple to seed a sensory channel regulating structural forces into the material. Interfacing with a dedicated computer directing electrical current to areas where repair or reinforcement is required, or decreting certain areas, will enable this system to evolve as a result of the forces it is subjected to. All that needs to be designed is this cybernetic, self-referential system; the structure will take care of itself. Eventually, all known senses and then some to be discovered can be made part of the system, providing intimate links and interactions with its inhabitants, the physical environment, and open-ended stratagems.

Accretion technology is process- rather than product-oriented. I view life as a process, as a continuing experiment, and I postulate an architecture which is an integral part and supportive of this condition.

Who or what is it, impoverishing modern architecture? Learning from life, the unfinished experiment, the strategic goal is to bring about ever-higher orders or organization, utilizing limited raw materials and unlimited solar energy influx.

Water is the universal solvent. It can dissolve more solids than any other liquid known. Almost all chemical reactions require water as a medium. This is almost certainly the reason why life began in the oceans. When our ancestors left this wet environment, they had to internalize the ocean. This is the reason why our blood serum still has nearly the exact composition of sea water.

The ocean is like a soup, containing inorganic and organic matter, and retaining the better part of the solar radiation received by this planet. With a view to its eminent role in the history of the "Blue Planet," I am hopeful that mineral accretion and decretion processes will be open-ended, developing within the context of an evolutionary architecture, which will be nonlinear and provide us with unplanned surprises and miracles. HA

P&Z

Planning on Oahu 1959 to 1982

by Councilman George Akahane
Chairman, Planning & Zoning Committee

The significance of land use management in Hawaii is attributable to its ideal climate and the limited supply of buildable land. In 1959, Hawaii was the first state to have a land use plan. This plan formed the basis for the state land use classifications that currently prevail on all Hawaiian Islands.

1964 General Plan

On Oahu, the 1964 general plan was the first Island-wide planning document. It followed the 1959 charter definition of the plan, representing "the council's policy for the long range comprehensive physical development of the city." The plan was also influenced by the prosperous state of the economy, introduction of jet air transport, and adoption of condominium laws by the state legislature in 1962. It envisioned new communities developing in Makakilo, Central Oahu, and East Honolulu; and a $24 million waste water disposal system to support the anticipated growth. Landfill and reclamations were proposed for Magic Island, Keehi Lagoon, at Waimanalo, and in Kaneohe Bay.

The comprehensive zoning ordinance of 1961 that regulated the development during the 1960s had no height limit for non-residential buildings; the setback and density determined the height of hotel, apartment, and commercial structures. The floor area ratio for non-residential buildings was 5.00 in Waikiki and 2.00 for the rest of Oahu. The zoning districts established in 1961 remained out of step with the 1964 general plan and the several detailed land use maps that were developed from 1964 to 1969.

In 1969, the Comprehensive Zoning Code was substantially revised. The revisions included (1) a height ceiling of 350 feet for highrise buildings, (2) a new floor area ratio for hotels and apartments favoring consolidation of small lots into larger parcels, and (3) additional floor area bonuses for projects that provided public open space in business districts.

1970s Citizen Participation

By the early 1970s, the booming trend of the 1960s took a downturn. This, combined with the passage of the National Environmental Policy Act, gave both the citizen and public officials time to assess the results of the rapid growth of the past decade and to find a means of preventing reoccurrence of past mistakes.

> *"It would be prudent for . . . legislators to supplement future . . . regulations with proposals to . . . repeal some existing regulations."*

The 1973 charter recommended creation of neighborhood boards "to increase and assure effective citizen participation in decisions of the city."

In 1977, the new general plan was adopted, emphasizing the social and economic objectives and policies of the city. Also by the mid-1970s, in response to community concerns, many amendments to the Comprehensive Zoning Code were initiated by the council. These amendments included: (1) creation of five historic, cultural, scenic districts, (2) inclusion of neighborhood boards in the list of agencies reviewing project applications, (3) new regulations for Waikiki and Kakaako, (4) provisions for zero-lot-line development, and (5) reduction of hotel and apartment densities. The subdivisions ordinance was amended to require park dedication by developers of more than four residential and apartment unit projects. The shoreline management, flood hazard prevention, and many interim development control ordinances were adopted.

1980s New Development Plans

In 1981, development plans for Ewa and the primary urban center of Oahu were approved by the council. On this year's agenda are: charter amendment, general plan amendment, adoption of six new development plans, and the Comprehensive Zoning Code overhaul.

Summary

In the past two decades, the State of Hawaii and City and County of Honolulu have made significant progress in planning. Many well-intended laws adopted by the state legislature or the city council have added new layers of restriction and time-consuming procedures to the process. The Central Coordinating Agency created in 1977 to streamline and simplify processing of various applications, has not been able to keep pace with the volume of new laws requiring specific actions by line agencies.

It would be prudent for the state and county legislators to supplement future proposals for enactment of new regulations with proposals to either repeal some existing regulations, or fund the line agencies responsible for administration of new regulations to assure their implementation. HA

Where to go For BUSINESS DINING

RESTAURANTS & CATERING

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