SUBmercial: Research at its Closest Proximity
by
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A Terminal Project
Presented to the Faculty of
The College of Architecture at the University of Nebraska
In Partial Fulfillment of Requirements
For the Degree of Master of Architecture
Major: Architecture
Under the Supervision of Professor Dr. Sharon Kuska
Lincoln, Nebraska
May, 2008

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Project Abstract

Written originally on 09 April 2007

Statement of Intent

Located off the coast of Northern California, just west of Eureka and Humboldt Bay, it is the intention of mine to design a site specific research facility to primarily study oceanic activity. Responding to the planet's current environmental conditions, I feel it necessary for solutions to manifest themselves within the realm of sustainable, as well as in an interest for future energy sources. The planet's oceans hold one possible answer for this. By committing to a project that focuses on researching water at an extremely close proximity, it will also strive for the ability to be dependent on water for its own energy needs. Thus, the function of the structure will be of the highest expectation. Buildings make up the largest culprit of emitting carbon dioxide gases, but in addition to this, pollution of ground water and many others are directly related to my project.

The Required Research

Prior to any design implications being made, an extensive amount of research has to be completed in the respective area. I will do this by gaining the knowledge of a local professional at the University of Nebraska in the oceanography discipline, completing a summer independent study that strictly looks at the materials for their water qualities, and physically visiting the proposed site to do proper analyses within a week's time to capture necessary images and local information. Designing underwater architecture has become an immediate interest of mine. Reading several publications on previous designs, I believe the challenges of materiality, spatial volume, and structure of my solution will fully consume the first and second semesters. Finding relative precedent of underwater design is minimal, yet inspiring to attempt such a task to prove will allow myself to focus on the structural tectonics of the structure first, and any aesthetics, second. As the building will be more concerned with function, it is necessary that I fully understand all of the engineering aspects of submerged construction.

Site Specific

Selecting a site in the Pacific Ocean is one of complex steps. There are several organizations that currently hold designated areas for protected regions of both the California coast as well as the ocean waters. The Monterey Bay National Marine Sanctuary is a government funded organization who protects its offshore coast to the west of the city as well as along the coast. It comprises 276 miles of coast length and 5, 322 square miles of ocean area. The CWO, California and the World Ocean, focuses on the implementation of ocean and coastal protection for California, which also holds an area of protected land. The National Organization of Oceanic Atmospheres is the largest organization of this kind, and oversees ocean waters across the nation. The challenge then presents itself with selecting a site that does not fall within any of these predetermined boundaries of protected ocean water. Although, once the structure is built the surrounding waters will intend to be protected in the future as it will act as a research hub for the very context in which it sits. Speaking with accredited professionals and visiting the site is just as vital. Located on the coast of Northern California, it provides for an optimal site where research can be done. In an area of waters that are currently being protected by the government against further disruption, the site will be strategically located among these interwoven areas not to lie against an existing protected area.

The ability to measure sea levels based on the amount of water submerging the structure, as well as having constant weather conditions will lend itself well with the purpose of the project. In an overall area of the United States, one that is free from hurricanes and drastic weather changes, the possibility of such a research facility will be of much value. Accustomed to alternative practices of such things like supporting natural burial sites, environmental and nature organizations, the introduction of mandatory light bulb use, and the National Oceanic and Atmospheric Administration as the largest environmental protection agency, Northern California serves itself well to the addition of an alternative take on architecture. Recently a Cal State Poly research team investigated the pollution of California's ground water. The study focused on ground water that led to the Pacific Ocean through pipes, and from all the coastal cities in the state. Gathering enough information to set a new standard that requires a filtering system before any ground water is to be released into the ocean. This aspect could be an additional function of the research facility along with the measuring sea levels, running off of water energy, and researching oceanic activity.

Projected Program

The program consists of a research facility with its focus on oceanic activity, which will incorporate varying aspects of oceanic properties as they relate to the planet, the people, and the future dependence on our environment. Acquiring an amount of initial research on similar facilities will be on the utmost importance as this project develops. By submerging the entire structure, leaving only a storey's height above the water level, the facility will allow itself to be in the closest proximity to the subject of study. This aspect of design is what interests me the most, because when you place a facility like this in its subject matter, the outcome should be that much more valuable. The structure will act as an anchor that is hung from the coastal line into the water as it levitates above the ocean floor. It will rely on the tectonics of the connection between the main structure and the manner in which it engages the ground. Consistent with other research facilities the program will of such selection. Enveloping adequate quadrants for various studies, the structure will be divided into three to five stories, each housing a particular study program. Working together, the two or three main areas of study will be designed so that there is interaction and cohesiveness to achieve a common goal. Not to be decided upon at this early stage is the location of the lab itself. It could hold many options for placement, as either the only quadrant submerged in the water, or along with the four quadrants submerged. As with each part of the program, all will have many design options to be determined upon further research.

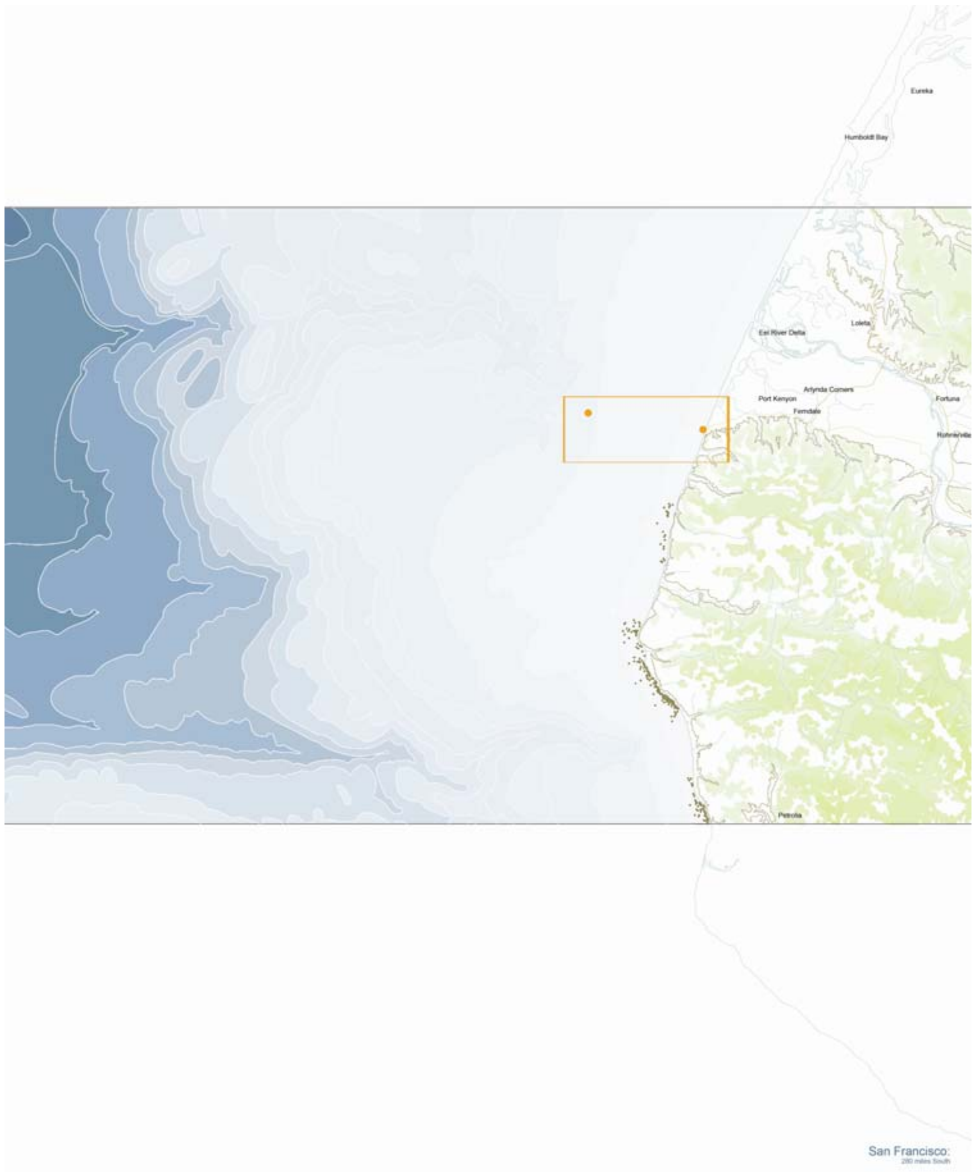
Methodology and Approach Strategies

Looking into history there have been several examples of underwater ruins across the world. Civilizations of Atlantis, Lumeria, and Mu have all been located underwater, but all have also been extinct for many years. The ancient ideas of living underwater and colonizing the oceans were only seen in a handful of cases for very pertinent reasons. The technology they held was clearly not advanced to sustain the population for an extended period of time. This causes me to investigate a summer independent study course on materials alone, studying materials and connections that are required in an underwater environment. Also, the way in which materials and interior spaces come together to create an air lock system is very important to understand. Ultimately creating a visually dynamic design, the exterior will interact with the interior simultaneously. As the main subject of research will be the water, the inhabitants are able to submerge themselves in the study, and in some cases, the urgency of the study. Water resource availability has come to the forefront of many sustainable discussions concerning our immediate future, in addition to water energy possibilities, rising ocean temperatures, and sea levels. Even holding the possibility for future colonization as the sea levels rise and encompass coastal cities, just as the ruins attempted, the ocean could rise enough to become a realization. And by promoting sustainability, this project will

make a great attempt at producing its own energy and adopting many green attributes though critical design choices.

An oceanic research facility has a great need for gaining information on our planet's past, current, and future state. The facility, as it is submerged into its subject, will act as an appendage of the water so to fully focus the attention of researchers. Underwater architecture could only have many venues for future design, so this type of project has an incredible amount of interest for me. To begin research on a subject that has many previous studies, oceanic activity, and combine it with one that has only been at the cusp of design, underwater architecture will be exciting to develop.

MS.



Eureka
Humboldt Bay
Eel River Delta
Loleta
Arlynda Corners
Port Kenyon
Ferndale
Fortuna
Rohnerville
Petrolia
San Francisco:
280 miles South

Mission Statement

I am interested in the act of research, being both literally and figuratively submerged in the study. I will create a facility, a greatly needed facility, which will research the physical oceanography of the North Pacific Ocean.

Physical Oceanography is the science of the sea in its broadest terms, and in its most detailed definition is the study of physical conditions and processes, it's motions and properties, that occur within the ocean resulting in climatic changes. There are two sectors of physical oceanography, the descriptive and the theoretical.

Critical Points of Project [3]
The idea of research occurring within the subject matter
The lack of Physical Oceanography facilities within the Northern Third of California
The form of its structure is to act as an appendage of the ocean, its subject

The most significant advances in the field have been due to the interaction between theory and observation. My intent is based around the lack of physical oceanic research in both, the world oceans and off of the Northern California coast. We as a people on Planet Earth know far more about the highest peaks then the deepest oceanic trenches. It was only in 1995 that the actual depth of the Mariana Trench was finally recorded. By the year 2005 the extent of coastline and its bordering waters between just north of San Francisco to the California-Oregon border was limited to a single institution participating in research. This left nearly 300 other lateral miles ignored within the parameters. With ground left untouched, also is the knowledge of the impact which oceanic activity has on the future, and thus, critical climate changes. As the world begins to depend deeper on its water resources, there will be an obvious need for further research.

The facility is to be located off the coastal city of Ferndale, California, 18 miles southwest of Eureka, California, and placed within the ocean waters. I believe by placing a structure in the subject matter, the quality of research will be strengthened proportionally. It raises many challenges that are not present inland. The project will be an extremely site specific structure. Pertinent research of this specificity has begun over the period of my independent study, and will continue throughout the year as needed. Many of the things I find to be influential to the overall design of the structure are also a part of the field the physical oceanography envelops. This allows me to understand the matter at a much greater level, which I intend to occur within the scope of the project; the act of research at its closest proximity.

With the proposal of an underwater application for architecture, I am hoping to further the interest in investigating alternative practices of architecture locations. The alternate in this case is maximizing what the planet can offer as a blank canvas. With such little amount of precedent in underwater habitation, and combining them with a type of architecture that is at the cusp of design is exciting to develop. I will ultimately create an appendage of the ocean so to fully focus the attention of its researchers.

R A.

Research. Analysis.

Resulting from my summer independent study course, I was fully aware of what to expect when I began to gather and analyze research.

From the initial phases of this thesis project, I knew that there would be little to pull from on a research applied basis, but a large amount of information in specified areas that I could then sew together. For example, I knew off hand that there was an immense amount of research done on submarine design and execution that I could apply those aspects to an architectural solution. I knew that spherical objects dealt with underwater pressure better than rectilinear ones. I knew the programmatic spatial layouts of existing physical oceanography research facilities. I knew what materials performed best in salt water environments.

Even without any actual examples that laid out my exact architecture solution, I could take when I needed from those various areas to create a solution that would be completely realistic. This would eventually become a challenge for me, but the amount of information I gained was worth it. With no precedents it requires a certain level of creativity and thinking to comment on a project that combines so many different research topics.

SA.

B.

N.

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SITE ANALYSIS.

Broad.
The area of Northern California in which the site lays has very distinct weather patterns, water systems, and surrounding geographical conditions. It is located 262 miles north of San Francisco on Interstate 101 and 112 south of the California-Oregon state border. The broad geographical conditions consist mostly of regional disturbances, climate averages, and surrounding flora and fauna, and can be found in the Appendix.

Nearer.
The closest town to the site is Eureka, California laying 18 miles to the northeast. It is the headquarters of the National Weather Service. The population is 26,000, and services Humboldt Bay with fisheries, a large bay, several marinas and tourist attractions. Arcata, California is the home of Humboldt State University and is 8 miles north of Eureka, the opposite direction of the site. They house two research teams that produce information through vessels studying Humboldt Bay. Nearer to the site is Ferndale, California; a small, rural town that is known for its historical Victorian style architecture on Main Street is only 1,300 people large.

On Site.
The ocean conditions are most pertinent to my terminal project. Not only are they the condition in which I will have to produce a functional structure, but they are the ones of interest of mine. The facility I will design will study physical oceanographic activity. These would include the coasts, currents, and cycles. In a short distance you can experience a sandy beach, rocky shores, 100 foot cliffs, sporadic rock formations, 0.00 foot elevations to 2, 200 feet elevations, intense waves or low waves, and anything from cattle farms to evergreen forests can be found. The point at which the project site was located is nearer to the sandy beach and cliff face. This location was chosen for its variance in the physical properties that each affect the oceanic properties the facility will research. Although the water conditions are at the utmost concern, they will slowly begin to affect and alter what happens inland, as history has shown. The coast line was surveyed to determine the ocean soil types, and the ocean floor slopes were calculated with a fathom-depth chart. The sand is black sand mixed with white shell pieces and grey rocks. Marine life consists of phytoplankton, kelp, otter, seal, invertebrates, and many fish species. The California current, the Davidson Current, will affect many natural occurrences within the Pacific Ocean. They are primarily wind-driven and travel south from the Northern borders of Washington and Oregon towards Southern California; with it carries nutrients that cause trends among the marine life. It can be so effective, that if the current is late or too subtle in bringing these nutrients, several marine life cycles are negatively affected. The tides that come with the currents also have an effect on the coast line, and will in turn affect the wave heights where they occur in cycles of every seventh wave being the tallest. The manner in which the physical conditions have a hand in each others' cycles or patterns is the prime reason for the type of research facility that is being proposed. To better understand the site conditions as a whole, including human context, one must travel one-half mile inland. There lies no other structure on the immediate site except a vacant building complex.

TR.

PO.

(′fiz·ə·kəl ′ō·shə′näg·rə·fē)

Topical Research

Physical Oceanography.

Once my idea was formulated and decided upon, I began to investigate the outlets in which I could find a solution. The broad outlets where a research was done within the subject include a Space Station in Outer Space, a Tree House in the Amazon, an Iceberg Shelter in shelf B15, a Volcanic Hub in Mount Maunaloa, an Earthquake Monitor in the San Adreas Fault, and a Submersible in the Pacific Ocean. When beginning to select a focused outlet from my list, the only intriguing topic I wanted to find out more about was the latter. I had no knowledge of Oceanography prior to this year.

The subject of Oceanography can be defined as such:

The Science of the Sea, including detailed subdivisions of marine chemistry, marine geology, marine biology, and physical oceanography, is such a broad topic that it covers 71% of the earth. Oceanography tries to know more about impacts that have potential information and advancement in global warming and climate change. It does this through looking at the role of the ocean in smaller terms. Marine chemistry, geology, and biology are easy concepts to grasp, but once again I came across a topic that intrigued me, insert physical oceanography. What is Physical Oceanography all about?

It is the study of physical conditions and processes, and the motions and properties of the ocean.

To divide it further, it can be separated in two. The activities being either descriptive and theoretical, or observational and theoretical, rely on systems that produce analytical maps. The descriptive half deals with observing the oceans that result in spatial and temporal properties of the ocean as 2D or 3D images. These images, often large scale maps, are then used to construct theoretical models that hope to solve and explain the observations made by the images. The knowledge of outside sciences is vital to understanding physical oceanography, and they can be fluid mechanics, optics, acoustics, or electromagnetics. To aid in the full engagement of this topic, and to realize it true scope, I tied it to current advancements in Oceanography have that occurred within the last 50 years.

_Confirmation of the Equatorial Undercurrent
_Elucidation of the formation of Deep Basin Waters and their Circulation
_Abandonment of the “known surface current” and “depth of no motion” concepts
_Observational Confirmation of the Ekman Spiral
_Overwhelming Contribution of Mesoscale variability to overall kinetic energy on the ocean
_Emergence of Numerical Modeling, particularly simulations that achieve Mesoscale motions
_Better Understanding of the importance and mechanisms of Internal Waves

_Better Understanding of the importance and mechanisms of Edge Waves, and their relationship to Coastal Topography
_Accurate Wave Modeling
_Deep Ocean Tide Measurements and Global Satellite Sea Surface Height Measurements to facilitate Modeling and Earth Dynamics Research
_Coupling between fluctuations in long-term Climate and Ocean Circulation [ENSO Phenomenon]
_Use of Computers for objective Analyses of Data, and for Modeling
_Use of Drifting Buoys and of Variable-Depth Floats
_Development of Portable Laboratories for Shipboard Use
_Integration of Satellite Technology into mainstream Research
_Greater Understanding of Sampling Designs, as they relate to the Physical Phenomena of Interest

With the amount of instances where Physical Oceanography has aided to our basic and definite understanding of the world's waters, it is an area of research that is severely lacking. The tools associated with this research, however, are very technologically developed. They include such tools and equipment as:

Digital Equipment Corporation (DEC) Alpha 3000. SSB Satellite Electronics. VHF Radio Electronics. Long Range, Short Range RADAR. Furuno Color Pathometer. GPS Electronics and Plotters. Salt Water Temperature Sensor. SIMRAD Hydrographic Surveyor.

The list of tools may suggest they are large in size, but can be run from the size of an average laptop. These eight machines receive data from satellite locations and compile weekly information that is eventually printed out in the form of maps and diagrams that are then analyzed by researchers. This is the aspect I hope to capture in my design.

The various areas of study one must understand before grasping Physical Oceanography include, at minimum, the following concepts: Ordered in the natural step of understanding, with the basic ideas first.

1. Properties of seawater, equations of motion and continuity of volume, geostrophic motion, stability and double diffusion, ocean currents.
2. General properties of waves; surface gravity, capillary, inertia-gravity, internal, Kelvin, Rossby; continental shelf and coastal trapped waves; many illustrations of how ocean variability can be described by free and forced waves.
3. Shallow-water theory, Poincare, Kelvin, and Rossby waves; boundary layer theory; wind driven ocean circulation models; quasigeostrophic motion on a sphere, thermocline problem; stability theories.
4. Classical linear stability theory of fluid flows with examples and applications in geophysical fluid dynamics. Specific topics include inviscid, viscous, and stratified parallel shear flow, thermal convection, double-diffusive systems, and rotating systems.
5. Dynamics of wind-driven coastal flow. Effects on coastal flows of coastline geometry, bottom topography, friction, and density stratification. An overview of the physical processes for advanced graduate students.
6. Forced and unforced equatorial ocean waves, reflection of equatorial waves from ocean boundaries, equatorial currents, El Niño/Southern Oscillation dynamics.
7. Large-scale ocean dynamics and observations. Linear theories. Classical nonlinear theories. Ventilated-thermocline model and applications. Relation of thermocline to ocean circulation.

HSU.


HS Univ.
Woods Hole OI
Alvin
Monterey Bay ARI
Scripps IoO
Posideon Resorts

INTERVIEW

Dean of Oceanography Department, Greg Crawford.
Location, Humboldt State University Campus
Arcata, CA

Key Points from the Discussion, held on 29 July 2007.

Physical Oceanography is what is known in the field of Oceanography as an "Ocean Observing System".

Humboldt State University is the only location in the entire state of California who has an undergraduate program in Oceanography, making it the most prestigious institution to gain this valuable knowledge of their coast and ocean waters. I found this to be a very surprising fact

Government funding and convincing has only recently occurred in the past several years for the type of operations at Humboldt State. The existing organizations already approved are NOAA, the NAVY, and Homeland Security.

The Ocean Protection Council is the regional version of this type of organization.

Large size Oceanic organizations and research teams will typically collect data and information four to six times annually. The somewhat small amount of times data is gathered is largely due to the size of physical oceanography within the whole of oceanography. The remaining areas within oceanography consist of Monitoring the climate from deep space, Early warning of CO^2 build up, Analyzing the role of aerosol in global climate, Analyzing abrupt climate change, Profiling the global ocean, Global ocean observation, Detecting global warming with sound, Pinpointing long term ocean cycles, Polar ice revealing ancient climates, World ocean circulation, Deep ocean global circulation, El Niño, Monitoring oxygen levels in the atmosphere, and Communicating global climate change science. Therefore, Humboldt State is the only organized institution conducting physical oceanography by itself, singlely. As a part of the College of Oceanography, it is able to employ three research vessels, most notable the Coral Sea.

The moments of time that are captured are then investigated and analyzed by Physical Oceanographers.

There are seven areas that are always researched in Physical Oceanography, and can be added to when the condition lends itself to that. The static seven are studying temperature, salinity, pH-level, dissolved oxygen, chlorophyll concentration which dovetails with phytoplankton upwells, terbitidy, and sea level.

The phytoplankton plays a major role in the patterns and cycles the ocean goes through every year. In the spring months the winds will become more westward, the phytoplankton will bloom as the warmer water rises up from the bottom. The increase in this nutrient will further affect the entire food chain and increase populations in many species.

Other individuals I spoke with include:

Don Wilkes from the Eureka Public Marina
Troy from the NOAA office
David Hall and Susie Hauser at the Humboldt Marina
Tim Sawyer and Jeff Robinson at the Maritime Museum on Woodley Island

CS.

SS.

Case Studies

The approach to such an unknown type or architecture will require several studies, each from varying subjects. The areas of design influence can be broken down into four main categories from which I can extract information using the following case studies. The following is to be used in companion with the presented information.

SITE SPECIFICITY

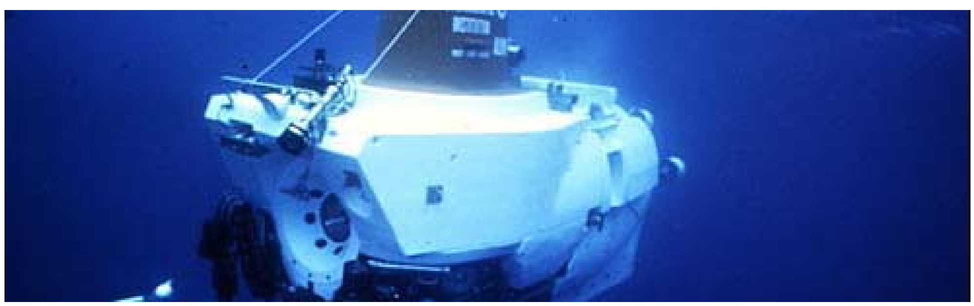
To understand the surrounding context of Offshore Ferndale, California the existing structures must be analyzed. The site is four miles from the center of Ferndale, following Centerville Road a two lane winding street. Ferndale is known as a historic town of Victorian Architecture, with a population of 1,300. The city of Eureka, the headquarters of the National Weather Service, is 18 miles to the northeast along Highway 1. The four mile stretch on Centerville Road passes several rural homes with adjacent ranches with farm animals, and is very similar to that of rural homes in Nebraska. The homes are more concentrated nearer to Ferndale and become sparse towards the coastline, with one home a mile away.

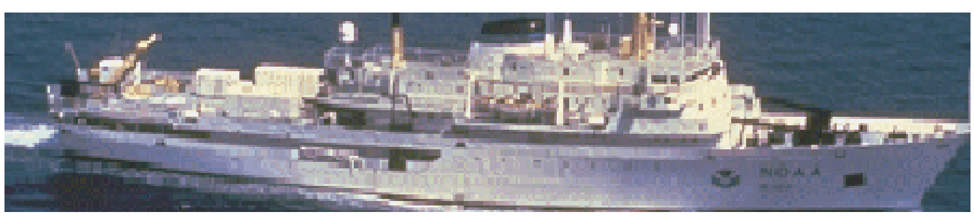
Eureka, CA.
The city of Eureka is a big destination on the weather map, being the national headquarters of the National Weather Service, but more importantly it is also a location of NOAA, the National Oceanic and Atmospheric Administration. Sitting within the Humboldt Bay, the town experiences many oceanic patterns and cycles on a daily basis. The area is very progressive and very pro-alternative energy.

Ferndale, CA.
This town is very small and very rural. As the artery from Highway 1 descends into the heart of the town, the roads are dotted with farming homes with adjacent ranches. The crops being cattle and steer. The main attraction here are the Painted Ladies, but also the beach at the end of the road is a large reason why people will travel through Ferndale.

Centerville Road.
This road serves primarily as a connection between Ferndale and Centerville Beach. It is a picturesque path to the ocean, and is one that is on the edge of a tectonic plate where on the North the land is flat and a part of the Eel River Delta, and to the South the land erupts from the ground in rolling hills covered in Redwoods.

M.



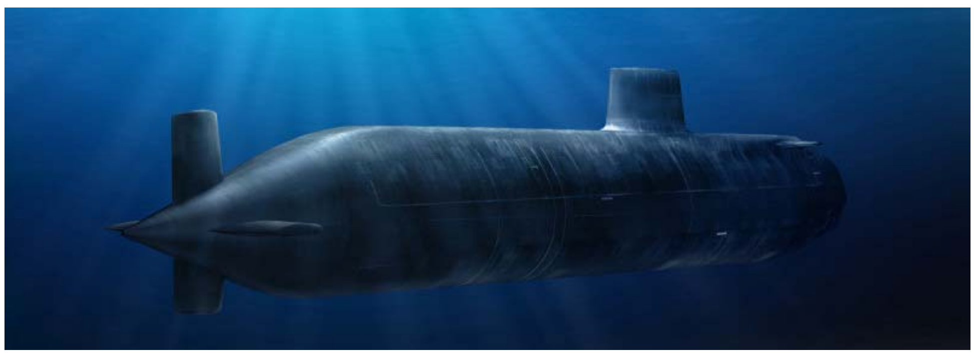


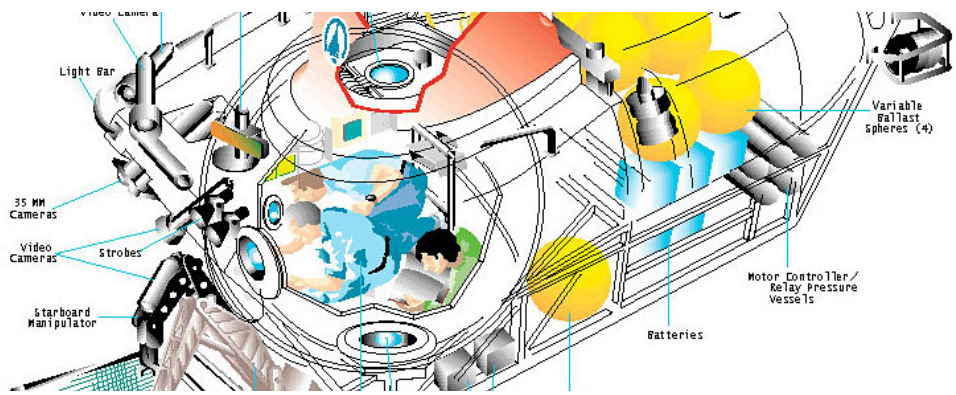
The materiality and the function of the materials are critical to the overall performance of the facility. By analyzing and research existing underwater structures and objects it is just as clear when one fails in a corrosive environment, as when it succeeds. This comes from the way in which materials are added to the basic structure. A complex layering system will be exploited in my terminal project. I will gain knowledge from similar underwater applications where material has been the sole proprietor of its function. Salt water causes the majority of structural materials to corrode if left unprotected or if applied incorrectly. Various actions will either delay this or accelerate it, mainly being the velocity of surrounding waters. Typically the faster the water is moving over an object the faster it will corrode. Such case studies can include shipping, navigation, and hull material for their long periods of exposure to salt water. Whether it is a steel structure encapsulated in acrylic and painted with an antifouling coating, or a titanium structure with copper alloying that is then coated with a system of antifouling, all variants in corrosion systems are covered. I have extensively surveyed all materials that can enter the salt water environment, and compiled the information in the accompanying document, Materials Palette. In very broad summarizing, I have found that titanium is, by far, the only metal that is known to never corrode in salt water whether left uncovered or covered with an antifouling agent.

Alvin.
The submersible, Alvin, is employed by the Woods Hole Oceanography Institute and has been in action since 1964. Various versions of Alvin have been produced, but not because of its materiality. Form and function were the pure motives. It is cast in entirely titanium sheet metal, that when it is in the water is resistant to corrosion, and when above water is cleaned and restored before each dive. It will make an average of one dive per one-and-a-half years. Alvin works with a layering system where each material adds to its function, with the interior walls also being made of metal and able to hold the necessary instruments for research.

Malcolm Baldrige Vessel.
This vessel is used by NOAA in their research department, and is made of similar materials to that of an ordinary boat or ship. The water is first in contact with a fiberglass shell, covering a second metal alloyed shell that in this case is aluminum because of its light weight. The basic shape of the vessel is made from a wooden rib-frame that is filled in with foam.

S E.




Light Bar
35 MM Cameras
Video Cameras
Strobes
Starboard Manipulator
Variable Ballast Spheres (4)
Motor Controller/ Relay Pressure Vessels
Batteries

MS.

STRUCTURE AND ENGINEERING

Ocean Oil Rig, Pacific Ocean
Another ocean vessel to investigate for its properties is an oil rig. Oil rigs hold information in structural calculations, and are either a floating device or structurally placed to an ocean floor. Here, the system of connections to support the equipment, live, dead, and weather loads will be most critical in the way they dovetail with the weight of the structure in water and on land. Oil Rig construction can be any of three; the platform can be attached to the ocean floor, it can consist of one or more artificial islands, or the entire structure can be afloat. As the size gets larger, secondary platforms are attached using an umbilical-like system. The types that connect themselves to the ocean floor are made of concrete or steel legs used in steel jackets or concrete caissons. Each type is floated into place and then either secured to the floor or left to be buoyant. In California, there is a petition that oil rigs no longer being used act as artificial reefs, as so many fish and marine life have inhabited the surrounding areas.

Astute Series Submarine, US NAVY.
The submarines of the US NAVY will go through an average of an 8 year design period, with a 9 year construction period. They are always constructed within a warehouse above water. The Ambush Bow is part of the Astute class, producing three submarines of the same parameters. It is designed for 70 continuous days submerged, and made of steel to displace 7,800 tons of water. The dimensions, in meters, are 97 x 13 x 10, and can dive to 300 meters. A design just unveiled for a new submarine mimics that of a duckbill platypus in form. The shells of submarines are where their structure lies, with the interior floor plates hovering in place.

Alvin, Woods Hole Oceanography Institute.
The instrument, Alvin, is the primary submersible used by WHOI in the Atlantic Ocean, and has been able to explore other major bodies of water recently. Made out of titanium, the most corrosive resistant and heaviest of the oceanic metals. It is strikingly similar to outer space vehicles where the inner walls are full of tools and the fenestration is limited. Built in 1964, it was the first submersible to contain two human bodies, as well as being the first submersible in the ocean. Alvin, named after Allyn Vine its inventor, has bade many discoveries throughout its lifetime including a lost hydrogen bomb in the Mediterranean Sea in 1966, and exploring the first known hydrothermal vents in the 1970s. Every other year since its conception, sometimes every year, Alvin has made trips to the ocean floor.

MECHANICAL SYSTEM

Kansas State University Biomedical Research Institute.
The air intake system will require that enough fresh air be re-circulated within the occupied spaces. The KSU Biomedical Research Institute utilizes a similar system for the purpose of containing harmful chemicals in specified areas as well as issuing its employees with adequate breathing air.

PL.

In the lack of underwater physical oceanic research facilities, the opposite is true for the amount of relative research facilities along coastal boundaries. Over the past fifteen years, more oceanographic stations are being built, and have fairly recent program requirements. The largest factor to consider is the size and number of equipment the structure is to hold. These measurements will determine the adequate working areas and overall size of the research facility. As well, as there being cognitive research facilities in the present time, the programs of each tend to leave out several areas of study. Therefore, when compiling the whole of what is being researched, I can adapt my programmatic requirements to what is currently being ignored, as well as adapt them to my specific site. The most often used research vessel is a hydrographic station, which has distinctive spatial requirements.

Scripps Institute of Oceanography, La Jolla, CA
This institute serves research in ocean and earth, and houses educational outlets. The areas of research are Oceans and Climate Change where Physical Oceanography lies, Earthquakes and Geology, Marine Biotechnology and Biomedicine, Marine Biodiversity and Conservation, Coastal Resources, Technology and Support of Oceanic and Atmospheric Research, and Scripps Graduate Department. This area within the Oceans and Climate Change department is where I have gained the most influence in producing a program. The proportion of Physical Oceanography research is so slim within Scripps, that it only comprises 6 percent of the whole.

Woods Hole Oceanography Institute, Massachusetts.
Positioned in the Atlantic Ocean, the institute covers Oceans and Climate Change, Coastal Science, Geology and Geophysics, Natural Hazards, Ocean Life, Ocean Resources, Polar Research, Pollution, Ships and Technology. One of the leaders on the East Coast, the institute reaches very expansive research testing sites throughout the Atlantic Ocean. Woods Hole employs REMUS, Remote Environmental Monitoring UnitS, submersibles within the Climate Change and Oceans study.

Monterey Bay Aquarium Research Institute, Monterey Bay, CA.
MBARI's research techniques fall into those of advancing technology for the sake of Oceanic Observations. They house four systems that each survey the circumference of the Bay, Monterey Ocean Observation System, Monterey Accelerated Research System, Autonomous Ocean Sampling Network, and Land/Ocean Biogeochemical Observatory, with the addition of its Aquarium as its largest attraction. None of the four research Physical Oceanography, but they do hold necessary techniques that are adaptable in the given site.

Humboldt State University Research Vessel, Coral Sea, Arcata, CA
Located 18 miles northeast of the proposed site, it is the nearest research being done in Physical Oceanography. For decades the University was the single organization conducting oceanic research in the area from Monterey to Oregon. The Coral Sea is ran by its Undergraduate students and is only capable of surveying the extents of Humboldt Bay.

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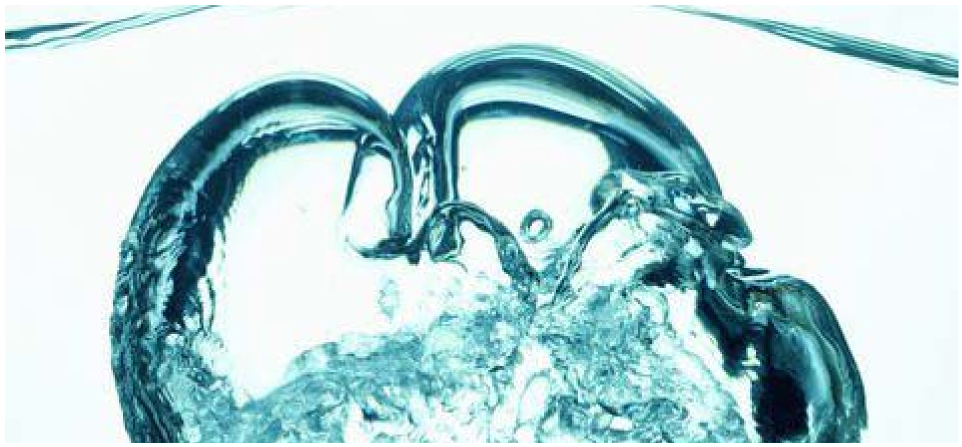

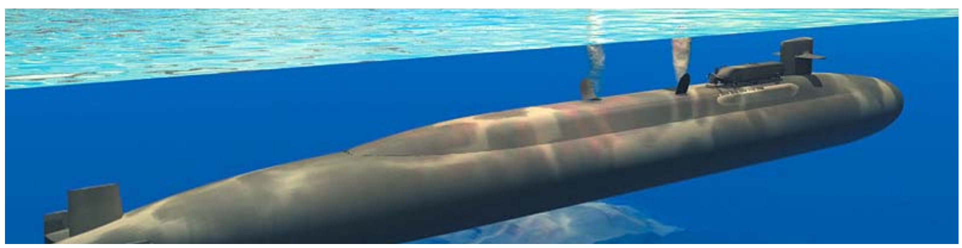

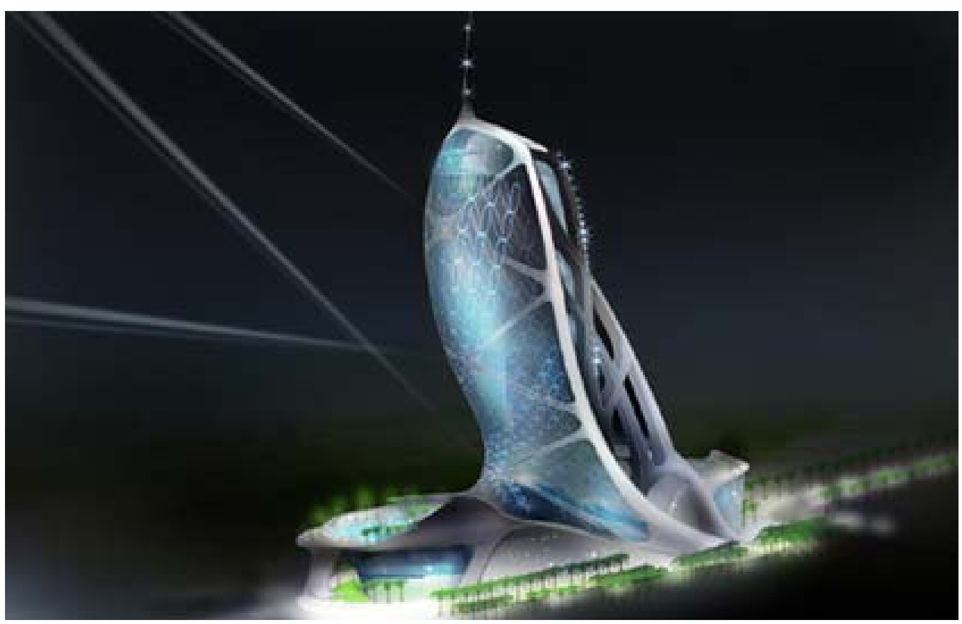

FORM

To initially think about a form that is to be placed underwater, I looked towards organic ones. I made a list of naturally occurring instances where forms were made from underwater environments. I wasn't sure how they would inform me when thinking about my design, but were merely aesthetic for this purpose of a case study. Literally to see what was out there in the ocean.

Bubbles.
When I began gathering images of either water bubbles or air bubbles, I became very intrigued from the first instance. To me, an air bubble was a de-material object that was captured in one single moment in the picture frame. There is a time before and a time after, and that was a very interesting idea to investigate. Bubbles happen all the time in water, but the causes of them are nearly always different. Another similar thing about bubbles is their circular or rounded shape. Having a prior knowledge that circular and spherical shapes perform best in underwater conditions with the amount of pressure involved, I expected to see these same forms. The variance of these curves and forms I couldn't have predicted. The array of sizes of curves within each bubble was very vast.

I will dive into this area quite often throughout the conceptual design of my project.

Submarines.
A submarine is designed so that it can glide as easily through the water as possible. It is not meant to stay in one place and hover in the ocean, but rather is always in motion. Shaped like a bullet, it is slender with little protrusions on the surface. When looking at this form the information I took relates to the purpose of it, and in this case to move quickly through water. The facility I would design would do the opposite.

Underwater Architecture.
As I was gathering information on existing structures currently being built, I noticed the forms these buildings took. In Duabi, the Crescent Hydropolis Hotel takes on an unusual form sits on the ocean floor almost as a beacon that reaches upwards towards the surface. A tall, skinny shape that assists it to accommodate its vertical program, the form adopts subtle curves and bubble aesthetics.

HP.

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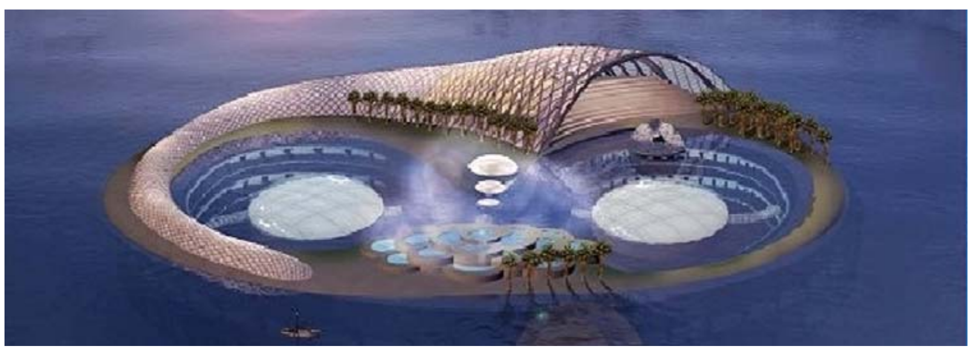

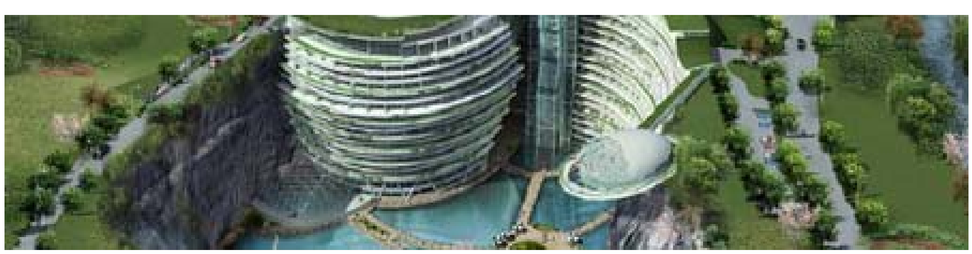

HUMAN PROPORTIONS

Human Proportions were important for me to investigate the precedent of what environments humans have been in when underwater and in submersibles. As in all underwater structures, the proportion between one person and the body of water in which they are in. With the exception of the two newly constructed underwater buildings, the past objects have been very limited in their spaces. Submarines have small, tight corridors and narrow stair tubes. They have very low ceilings and the common spaces are often too small for those inside, including the double bunk beds in the living quarters. In general, submarines only leave enough space that is absolutely necessary for humans to occupy. The same goes for Alvin, the research pod of Woods Hole, where two men can sit comfortably, but is not meant to do anything else. In Alvin, the container is very close in size to that of the space the men occupy. This one-to-one ratio is very opposite to a submarine.

UNDERWATER ARCHITECTURE

Hydropolis Hotel in Dubai.
There is a minimal amount of previous works of architecture that have been designed in an underwater atmosphere. The most recent project of underwater design comes out of Dubai. The Crescent Hydropolis Hotel is the first hotel to be designed underwater, and is currently under construction. The amount of news and press the hotel has received is fairly high, but the amount of detailed information on the basic engineering is not. Every few months, there have been new updates to the website, and make it easier for me to gain additional information from more than just renderings.

Poseidon Resorts in the Bahamas.
Just off Eluethra Island lives an underwater resort planned to open in the following months. This utilizes a steel structure that is wrapped in acrylic matter, and has remained open and functioning from the day it finished construction. The Lodge is 200 square feet and weighs 44,000 pounds in water and 300,000 pounds on land. The vertical circulation resides in two elevators that carry guests from the water's surface to the individuals units. The surface of the water is visible from each unit.

WaterWorld, China.
A design competition named the first place winner as WaterWorld by Atkins Design Group. It is very similar to that in Dubai, and has over 400 units placed in 12 stories with the bottom two underwater on the edge of a natural quarry. Though not necessarily an underwater structure, it still has to adapt to water in and around the structure.

SO.

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AM.

Strategic Objectives

I will strive to achieve several large concepts in my terminal project. I hope to broaden the scope of architectural sites to include that of the open waters. I see a need for filling the void that exists in the field of Physical Oceanography is of great necessity in my opinion in relation to the planet's current existence. I will build upon my architectural education through a new approach to design, one requiring vast amounts of research itself in order to fully understand and perform the necessary design tasks. The criteria I will follow and abide by throughout the terminal project are according to the Terminal Design Studio Memo:

1. The project will demonstrate a comprehensive, in-depth understanding of the theoretical and applied study processes learned throughout the course of my professional education.
2. The project should provide evidence, narrative and visual, of my realization of the initial design intentions, as identified in the initial project proposal and the programmatic conclusions produced through the inquiry process.
3. The project should provide evidence of my ability to address and resolve the issues related to architecture. For example, issues surrounding space, place, tectonics, and construction at building and/or urban scales.
4. The project should provide evidence of my ability to bring to bear both creative and critical thinking skills in the development of my design solution.
5. The project should demonstrate my ability to communicate the design intentions and designed results using clear and legible forms of architectural representation.

Approach to Methodology

My goal with the terminal project is to develop a very unique design that is both practical and has the ability to be realized. The site specificity will be the greatest factor to begin with. An ample amount of time will be necessary for me to complete the site analysis adequately. I will take positive and negative traits from past and present underwater applications to elaborate off of the positive and learn from the negative. The second most important element in the process of my approach is the materiality of the structure. As a process I will layer one piece of information on top of another, the materials must perform similarly. My methodology will be concentrated in applying detailed tectonics of all things structural, material, and spatial in a progressive manner to create a innovative result. Schematic design development will occur once all necessary research is completed. The individual spaces will come as an organic solution based on subcategories that influences design of both the engineering and architectural aspects. I will be gaining the knowledge in each subcategory by way of case studies.

Performance Criteria for Program

Throughout the duration of my terminal project, I will either substantially meet each NAAB criteria or go beyond the minimum requirements. The project is quite challenging when considering the tectonics, but is also a feasible expectation to meet in the sixth year having five precious years to prepare for such a task. I will discuss a possible example of how I will fulfill the criterion.

NAAB 1. Speaking and Writing Skills.

I have successfully developed a strong confidence in the architectural representation in both words written and spoken. Five years and innumerable formal and informal critiques or transcripts, have enabled me to describe any forthcoming presentation.

NAAB 2. Critical Thinking Skills.

It is a goal of mine to develop a design for my terminal project that is as true to reality as possible. By selecting such a site, a progressive architectural topic, and a realistic societal subject I have set myself up for the greatest outcome. It will force me to complete further research to expand my knowledge of underwater architecture principles, and perhaps develop new ones in a new field.

NAAB 3. Graphic Skills.

In the previous, it will be quite necessary for me to use tools to create photo-real images. They must all begin in a rough sketch platform in order to understand shapes and forms. My skill level with programs such as AutoCAD, Photoshop, 3D Studio Max, and InDesign has increased each year of my education and will only advance further during my sixth year. I hope to vastly exceed my previous skill level.

NAAB 4. Research Skills.

Extensive research will be vital to the success of my terminal project. Prior to the beginning of the Fall Semester of 2007, I have traveled to the general area and precisely selected a site, spoken with professionals of all points of view, and gathered images to guide me in my study. By analyzing text of materiality as it is concerned with the subject matter, I have compiled a palette of which I can utilize during the semester. These techniques will be used throughout the year.

NAAB 5. Formal Ordering Systems.

I will use the skills I have learned over the past five years in order to produce clear explanations of each design stage. The presentation drawings will successfully describe my intentions.

NAAB 6. Fundamental Design Skills.

I have acquired many skills that involve process, and being able to think critically in every stage, giving good reason for each advancement. The program and function will be developed based on many pertinent pieces of information. All of which will be determined upon my research.

NAAB 11. Use of Precedents.

The lack of precedents will make my process more challenging, and will force me to discover new approaches in underwater design. I have researched several oceanic engineering structures, and will do much more to understand it fully.

NAAB 12. Human Behavior.

I will uncover the relationship between a researcher and their subject, as well as a human being and their underwater environment. It will require in depth studies of both circumstances so that I am able to get a personal feeling of the spaces I am designing.

NAAB 16. Program Preparation.

The program will be developed based on the research of similar facilities, but will also have to be invented per the lack of program in this subject matter. The size, shape, and equipment requirements will be intricate enough to sustain the type of research.

NAAB 17. Site Conditions.

The site conditions are the most important determinant of how successful my terminal project will be. Being submerged in the ocean, it will require that I know and understand all the geographical conditions of the site. Understanding the corrosive nature and the buoyant properties of salt water, accessibility, and earthquake qualities all are vital.

ID.

Important Dates Throughout the 2007-2008 Semesters.

Fall 2007

Phase 1.	Programmatic Report. 27 August – 14 September	
Week One.	Programmatic Report Scheduling Project Methodology Work Timeline	[NAAB 5]
Week Two.	Create Faculty/Colleague Critique Group(s) Redefine and focus my Mission Statement Precedent Research Finalize the Scope of Research the Facility is to Adopt Case Study Analyses Describe the Primary Design Elements Site Evaluation	[NAAB 2, 4, 17]
Week Three.	Programmatic Report Due Finalize Faculty/Colleague Critique Group(s) Develop Presentation Standards for a Oneness	[NAAB 1, 3, 5]

Phase 1 Objectives.

Detail an adequate schedule of work to follow throughout the fall semester.
Call out, in writing, the criterion and guidelines I will follow for my terminal project.
Finalize the overall scope of my project.
Develop a set of presentation standards for myself to abide by during my process of design and personal critique.

Phase 2.	Research, Conceptual Design Development, and Site Studies 17 September – 12 October	
Week Four.	Site Analysis and Accessibility Selection of Adaptable Materials from Materials Palette Case Study Research Arrange Results Graphically using Presentation Standards	[NAAB 2, 4, 11]
Week Five.	Continue Site Analysis Possible Site Visit Continue Material Selection Evaluate Spatial Layout and Program Requirements	[NAAB 5,12,16]
Week Six.	Conceptual Design Investigate Possible Variants in Areas of Interest Evaluate Spatial Layout and Determine Program Locations Finalize Overall Scope of Terminal Project Finalize Optimum Spatial and Programmatic Requirements Preliminary Graphic Boards Layout	[NAAB 3, 6,12]
Week Seven.	[WEDNESDAY] Programmatic Review Presentation	[10 Oct 8:30am] [NAAB 1, 3, 5]

Phase 2 Objectives.

Create Strong Diagrams and Images to Convey the Project.
Apply the Research Completed with the Materials Palette, and all Palettes to Wall Section, Elevation, and Façade elements.
Conclude the Location, Accessibility, and Exact Placement on the Site.
Gain Critical Comments given at Program Research Review so that departure from Phase 2 into Phase 3 is clear and concise.

Phase 3.	Schematic Design Direction 15 October – 20 November	
Week Eight.	Incorporate Relative Criticism from Review Free-Form Studies Inspiration from Outside Elements, Natural Investigate Details in Critical Areas	[NAAB 2, 6, 17]
Week Nine.	Large Scale Analyses Locate Facility and Analyze	[NAAB 5, 12]
Week Ten.	Model Programmatic Spaces Large Scale Analyses	[NAAB 3, 12]
Week Eleven.	Possible Site Visit Model Analysis Preparation of Graphic Presentation Layout Design Development	[NAAB 2, 4, 17]
Week Twelve.	Graphic Review	[14 Nov 5:00 pm] [NAAB 1, 3, 5]

Phase 4.	Schematic Design Direction 26 November – 17 December	
Week Thirteen.	Incorporate Relative Criticism from Review	[NAAB 4, 6, 16]
Week Fourteen.	Finalize Conceptual and Schematic Design Design Development	[NAAB 5, 6]
Week Fifteen.	Finalize Conceptual and Schematic Design Graphic Presentation Layout	[NAAB 3, 5, 6]
Week Sixteen.	Graphic Presentation	[NAAB 1, 3, 5]
Week Sevent'n.	Final Graphic Review	[17 Dec, 1:00pm] [NAAB 1, 3, 5]

Phases 3 and 4 Objectives.

Complete all Previous Goals.
End the Semester with a Strong Design Direction.
Do all that I can do to start the Spring Semester adequately.
Incorporate Criticism from the Final Review, as well as all previous Reviews.
Calculate aspects throughout the Fall Semester, as either positive or negative, and develop plans to achieve the necessary result.

Phase 5.	Schematic Design Development 14 January – 29 February	
Week Eighteen.	Semester Methodology Work Timeline Schedule Critiques/Faculty Appearances Finalize Basic Requirements	[NAAB 3, 5, 12]
Week Nineteen.	Finalize the Form Develop 3D Forms to Examine Determine Outside Forces [weather, buoyancy, stability, docking] Begin ReOrganization of Plan	[NAAB 5]
Week Twenty.	Continue to Determine how the Forces affect the Structure/Materials Show Results from the Forces Graphically Continue Plan Organization as it Relates to the Forces	[NAAB 1, 3, 5]
Week T-One.	Finalize Floor Plans Begin Sections/Elevations/Façade	[NAAB 2, 3, 6]
Week T-Two.		
Week T-Three.	Prepare and Generate the Graphic Presentation	[NAAB 1, 3, 5]
Week T-Four.	Mid Review	[26 Feb 4:30 pm] [Sharon, Martin, Jeff, Peter]

Phase 5 Objectives.

Generate a final proposal of my project in order to prepare myself after Mid Review.

Phase 6.	Final Design Development Stage 3 March – 4 April	
Week T-Five.	Strategize Layout Ideas Find Any Missing Elements	[NAAB 4, 5]
Week T-Six.	End of Design Phase	
Week T-Seven.	Spring Break Begin Production Work Begin Graphic Layout of Items	[NAAB 1, 3, 5]
Week T-Eight.	Wrap Up ALL Loose Ends of Presentation	
Week T-Nine.	Final Graphic Presentation	[3 April 5:30pm]

Phase 7.	Final Production 7 April – 10 May	
Week Thirty.	Work on Book	
Week T-One.	Work on Book	
Week T-Two.	Final CD DUE	[24 April 12:00pm]
Week T-Three.		
Week T-Four.	Graduation	[9 May 5:00pm, ARCH] [10 May, DEVANY]

Phases 6 and 7 Objectives.

Develop a final presentation that I am happy with, and have done the best work I've done in six years at the University.

Solve all unanswered questions about the technical aspects of the facility.

Finish and Compile my Terminal Project Book.

AoDI.

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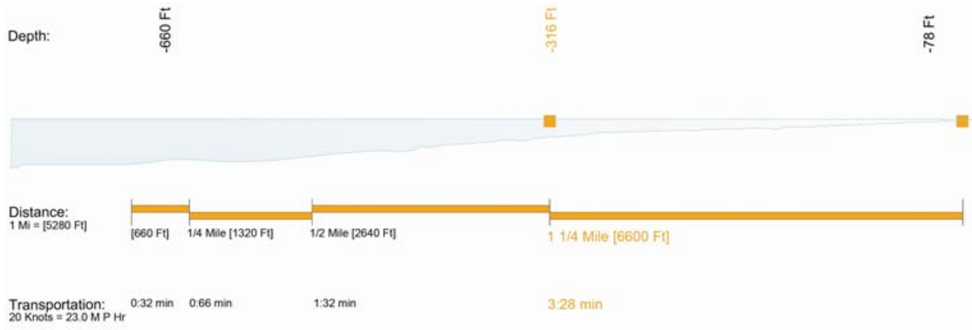

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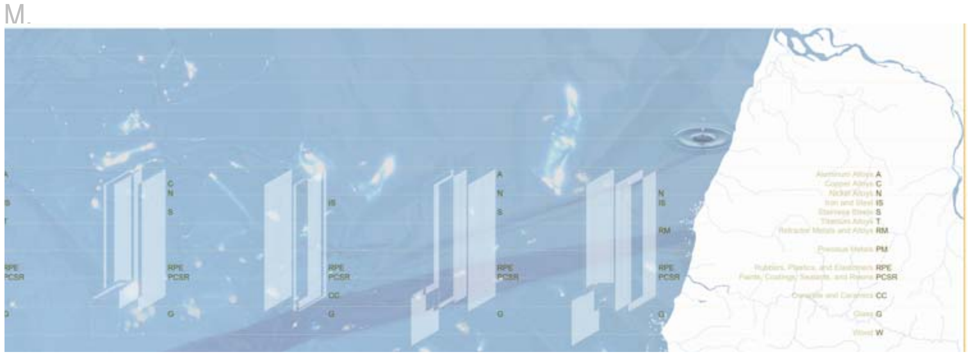

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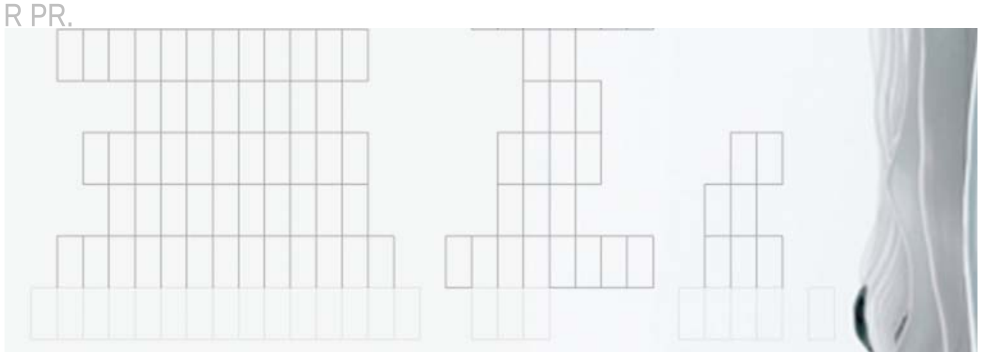


Areas of Design Influence

Site Specificity

A typical architectural project site will have variants to consider such as slope, weather conditions, soil structure, and surrounding context and archetypes. The weather can alter its characteristics, as well as the surrounding site context. In the case of designing a project in the ocean, several typical variants disappear. The slope will be transported to that of the ocean floor and its extents from the coast line whose elevation of 0.00ft drops to negative values once crossing the water line. The weather conditions would be found everywhere, and would always be an issue in the design phase, but there is an additional weather concern with the ocean. Properties of waves, currents, ocean temperature, and marine life cycles all require the proper knowledge before design is to begin. The soil structure and make up will be examined, but will differ slightly with the soil structure of sand and/or the ocean floor matter. There is no surrounding context in offshore Ferndale, CA, with the town of Ferndale four miles away on Centerville Road. Several rural homes dot the landscape within view of about one mile away from the site, and continue up towards the town. Along the coastline lie natural context in the grasses, trees, sand, and earth.

Materiality

The materials used will perform as the primary system to allow the building to function underwater; preventing both leaking or seepage, and the three main types of corrosion. A system made of up of layers must consist of those materials that are corrosion resistant in salt water. The document 'Materials Palette' is where the details of many materials can be found. As with all architectural projects, my project's success will be determined by the choice of materials along with other factors. Working cohesively with one another is a vital requirement. Each material will prove the reality component of my project, as they form a functionally sound building.

Organic and Poetic Formation

The nature of this facility, as it is placed within the ocean waters, will result in a form that is one with its surroundings. I will allow the current strengths, wave patterns, and the cyclical tides and motions to dictate the overall form of the structure. Taking inspiration from naturally occurring events within water, they will guide the direction of my design to achieve my goals.

Research/Programmatic Requirements

The spatial requirements within the research facility will be compiled from existing facilities with similar program. Knowing the sizes and working areas for each piece of working equipment, as well as determining the number of people necessary to perform such research, will determine the overall size of the building. Which in turn, will determine the weight and structure of the building as well. The program will be of my choice as far as picking the selected areas of research to facilitate.

Spatial Layouts

Total Research Study Area.		1800 s.f.
	8 Research Stations.	800 s.f.
	Dry Lab.	450 s.f.
	Wet Lab.	200 s.f.
	Research Deck.	350 s.f.

Equipment.

- Digital Equipment Corporation (DEC) Alpha 3000.
- SSB Satellite Electronics.
- VHF Radio Electronics.
- Long Range, Short Range RADAR.
- Furuno Color Pathometer.
- GPS Electronics and Plotters.
- Salt Water Temperature Sensor.
- SIMRAD Hydrographic Surveyor.

Total Common Area.		700 s.f.
	Support Space.	
	Living Quarters.	
	Kitchenette.	
Total Mechanical Area.		850 s.f.
	Hydro Powered Generator.	
	BioPower Reciever.	
	Mechanical Room.	
	Restrooms.	

Total Area of Structure.	3250 s.f.

IN CD.

Intent Narrative. Conceptual Design.

To begin my design process there were very early abstract images that I came into contact with. Because of the lack in current underwater or aquatic architecture, I had to rely on myself to produce unique ideas. I did this by taking thumbnails from my research areas and combined them to create ideas that could be realized if possible. So I looked at the materiality, structure, program requirements of my case studies to produce realistic combinations that adhered to human proportions, as well as were formed by the summer course work I completed on materials and environmental conditions. Doing this, by piecing together the basic information to develop something completely my own, was very rewarding.

My initial intent, coming directly from my proposal, was to design an appendage of the ocean that would act as an organic piece of the water. I had all of the necessary information to design this facility, but I was still lacking any kind of inspiration of form.

I began with investigating images of naturally occurring events or moments in time within the ocean or any body of water to see exactly what happened with normal objects.

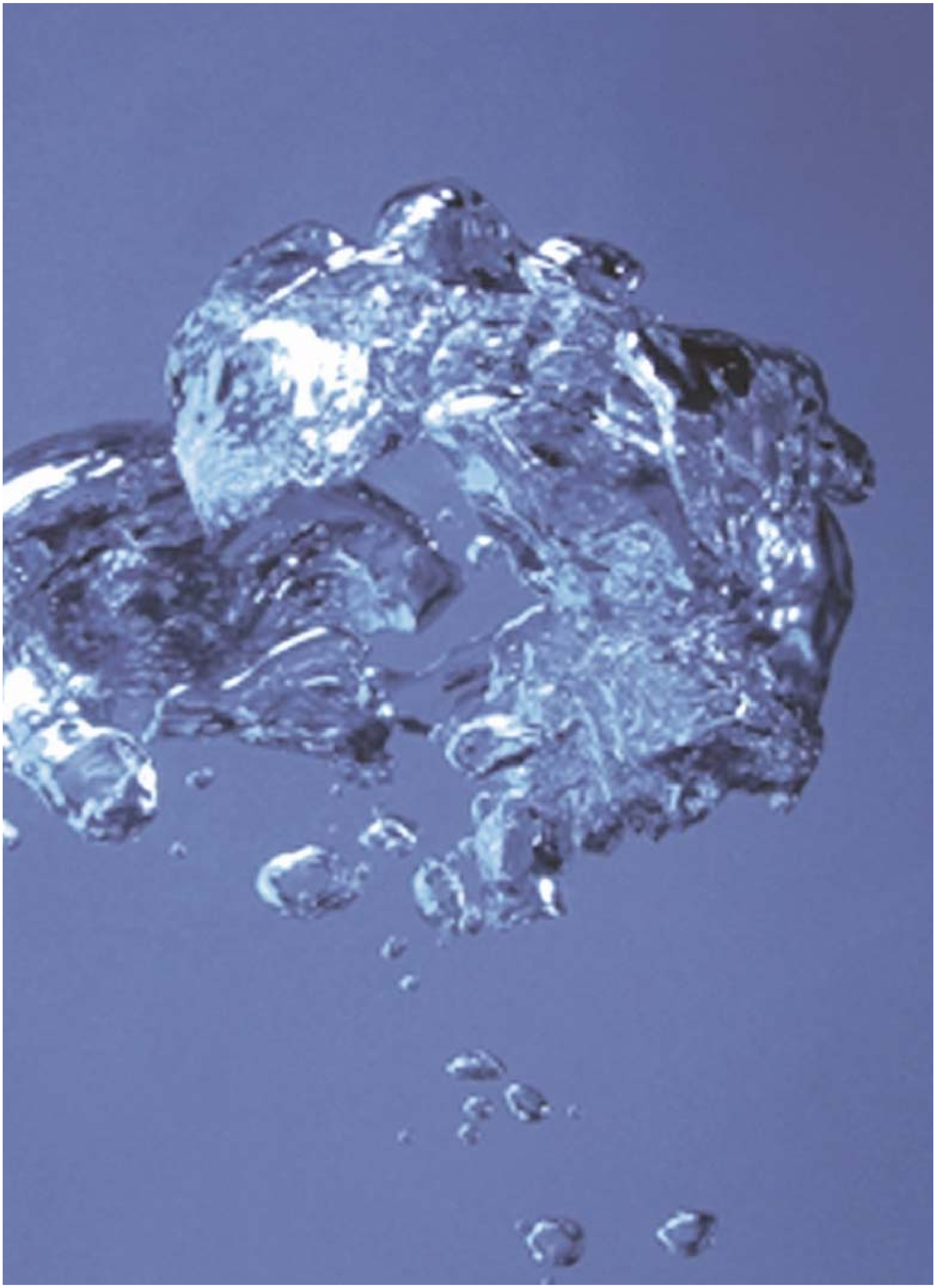
Bubbles.

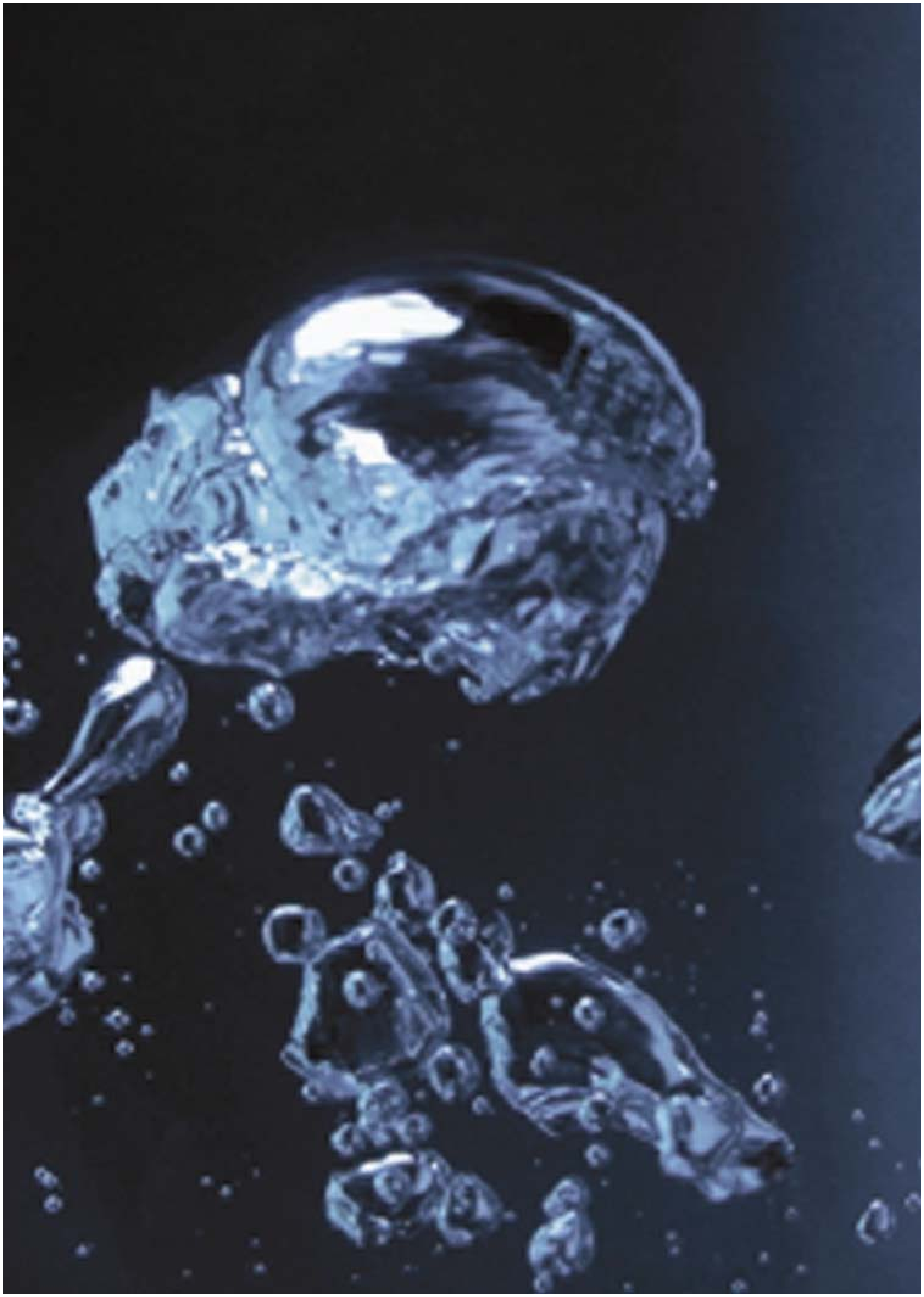
Bubbles represent snapshots of time when air capsules rise to the surface from movements below the water's surface. This aspect intrigued me because when speaking with the Dean at Humboldt State University, he used similar language to describe the process of physical oceanography research as happening within moments of time when data is retrieved and studied. So, the images I was able to gather as well a recreate helped me to understand their form and their process of formation. I chose to display the following as full-size for the reader to experience them the way I did.

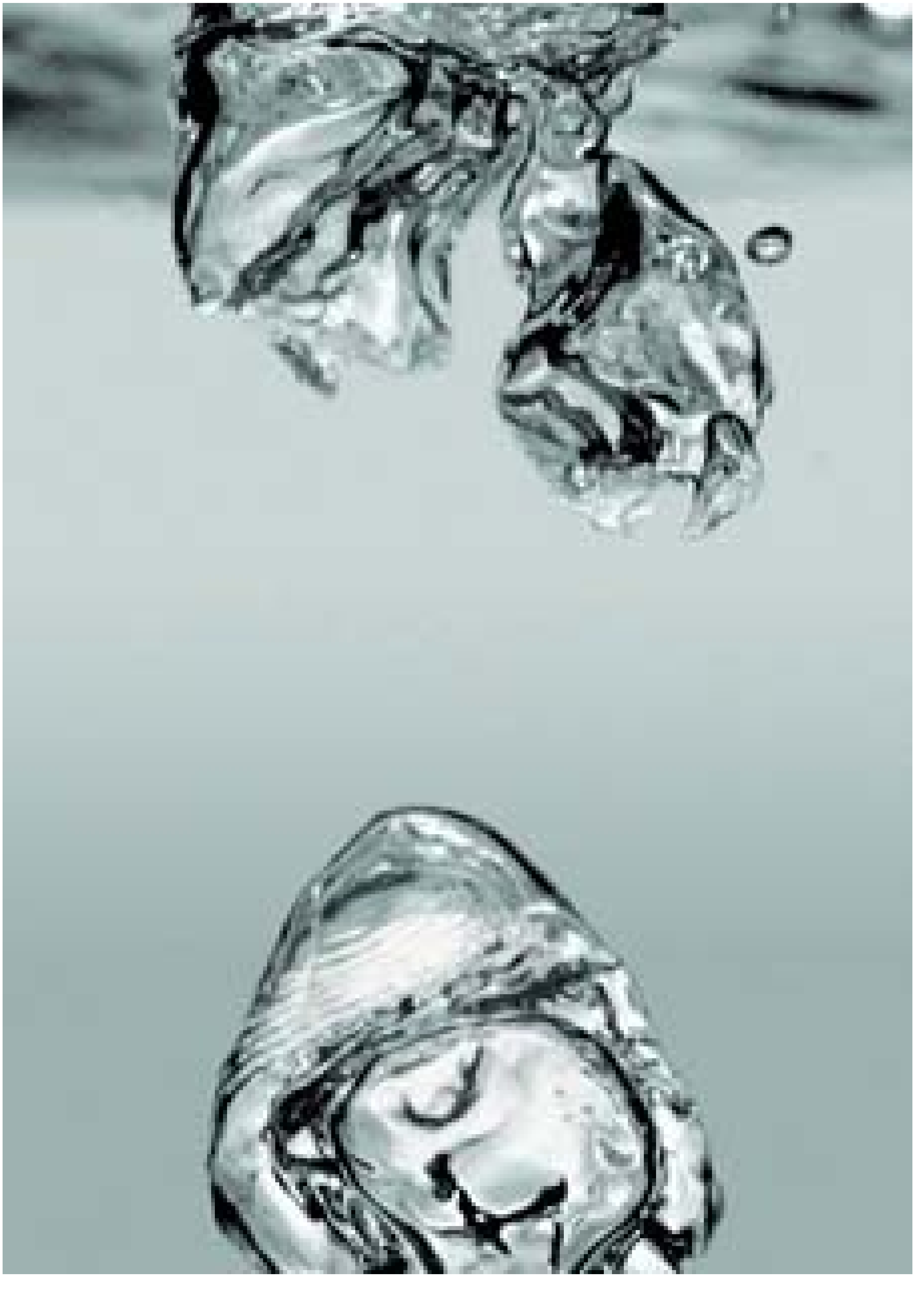
When I began to analyze these images to try and find or locate architectural tendencies within each bubble it was similar to when you look through a window to try to see the interior of a building. I could see its basic forms, and I knew what they were made of, but I had trouble really getting into them. In those basic forms I could also make educated guesses at how they were formed by looking at the variance in shape. I noticed that early bubbles were far more spherical than bubbles almost to the surface. They held to more common shapes of a circle, but once they grew in size and rose in height, I could tell that the forms became weaker the wider they got. The instability of these bubbles towards the surface told me that those forms were n of sufficient to the pressure around them and that what was causing them to burst.

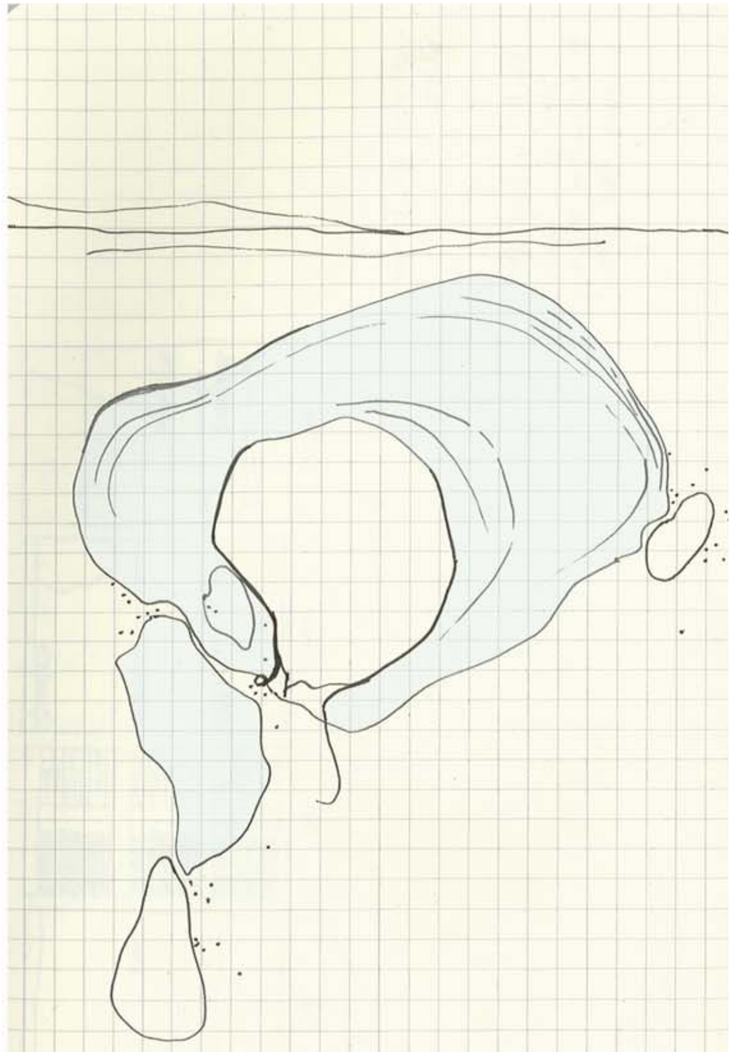
The next step in my process was to sketch these forms using them as pure inspiration. Once I did this I added architectural notation to try and get a sense of what forms could represent what part of the facility, whether it be a wall, a space, or just the research lab within.

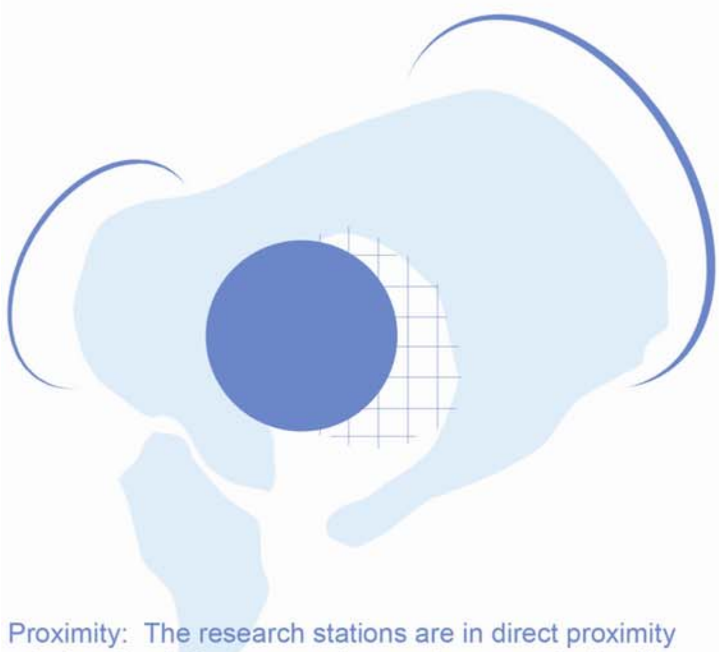
The last step of form generation was to recreate the process all together. I would find a medium that lent itself to both liquid and solid forms so that I could analyze them at both stages. I will go into more extensive detail on this step following the images.



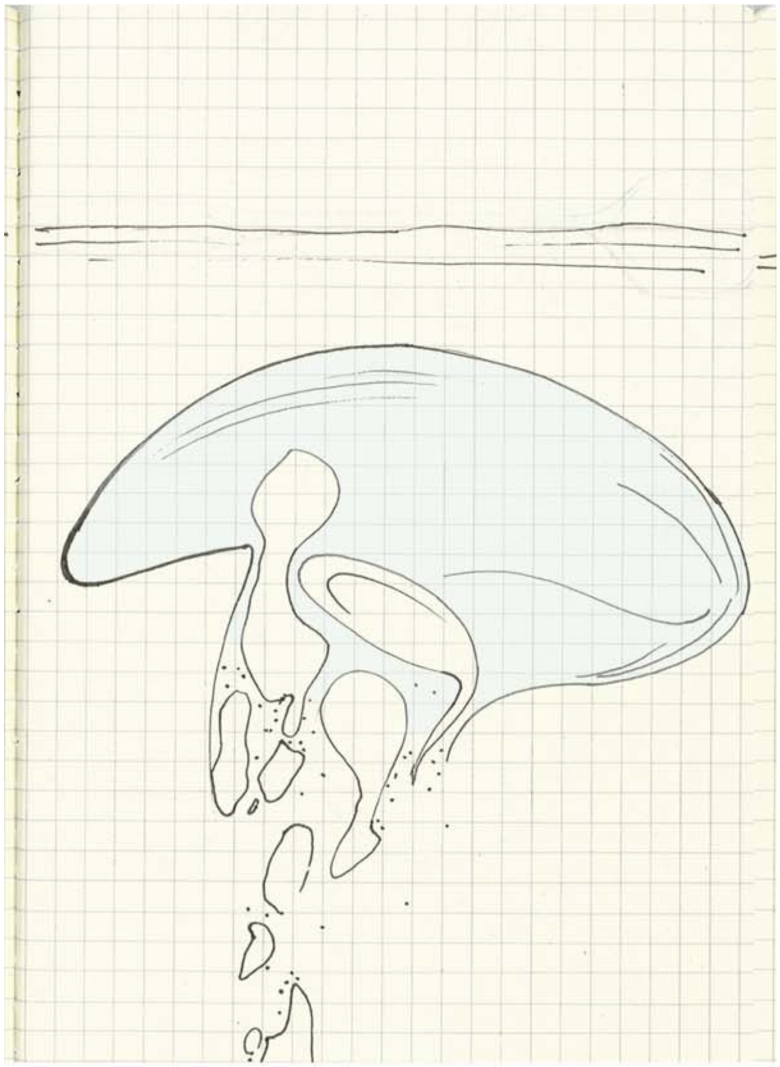


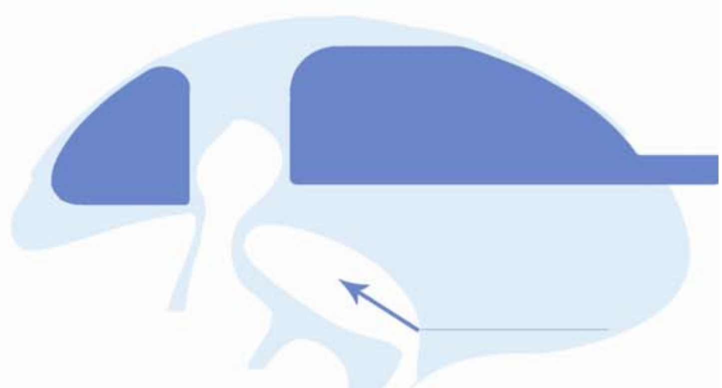




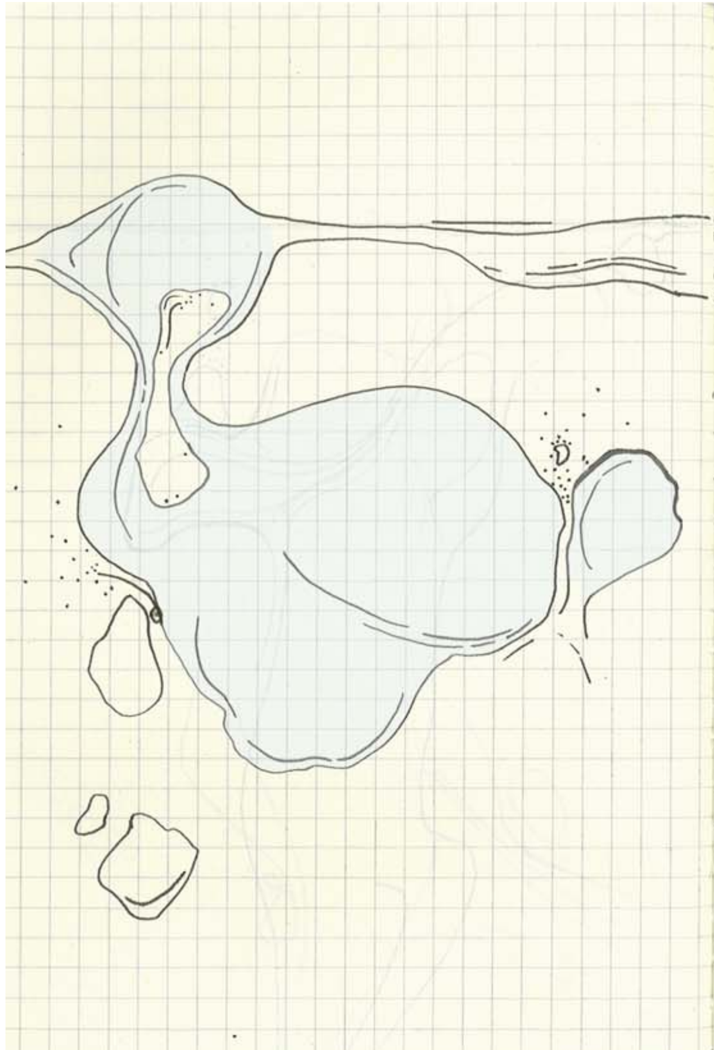


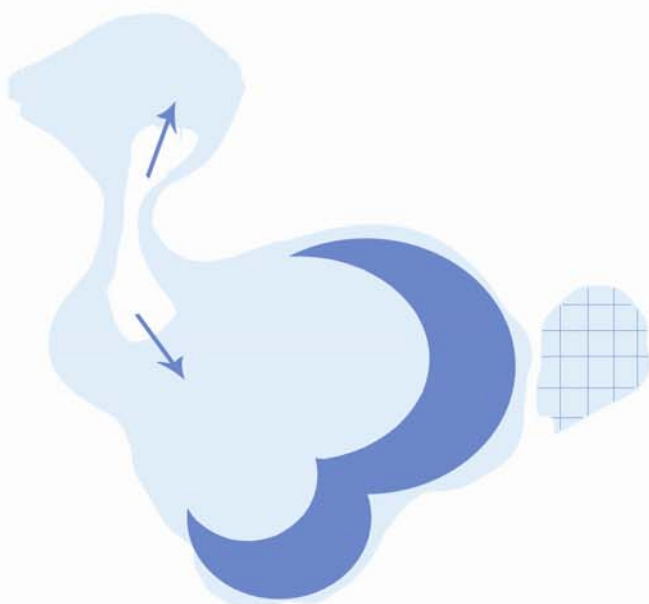
Proximity: The research stations are in direct proximity to the circulation core and support area, as both will be able to contain the power necessities.
Exposure: The stations on outer most edges will have the most desirable closeness with the subject.



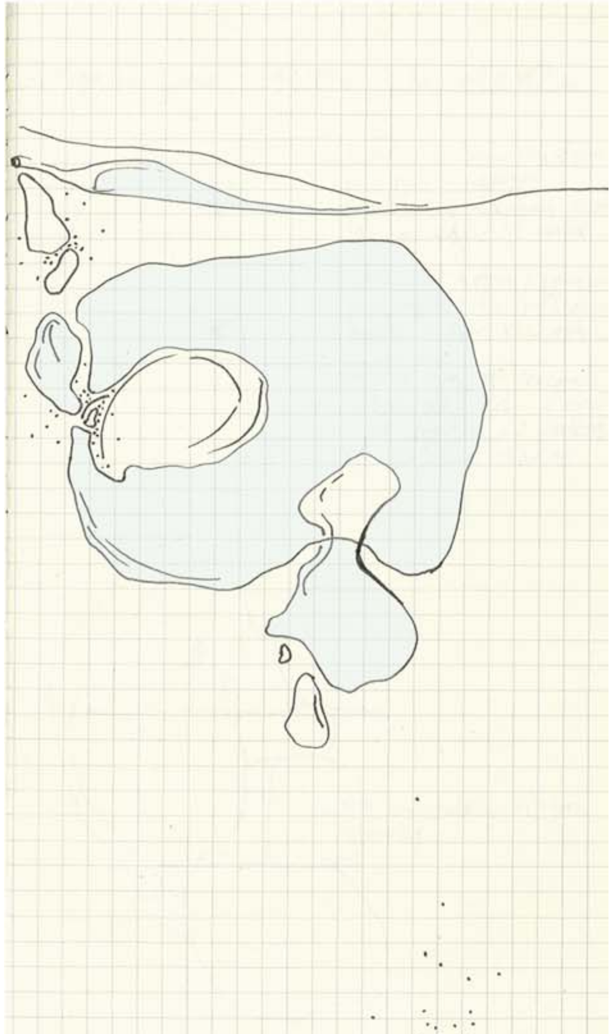


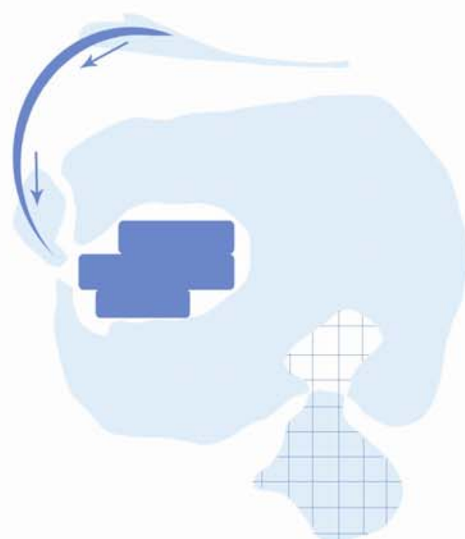
Form Indication: By adapting a vertical bubble formation to the central circulation core, the uses are similar.





Research: Greatest view of subject if placed on edge.
Satellite Location: Separate but feeds off of main core.
Connection: Provides a mass that connects research space to circulation/entrance core.
*Can be read in either plan or section view.

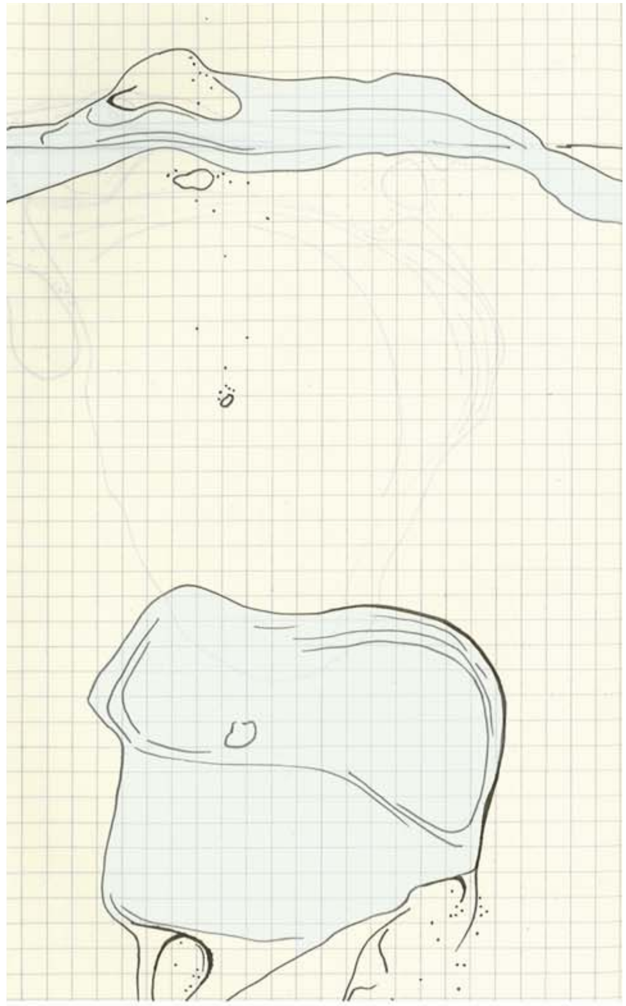


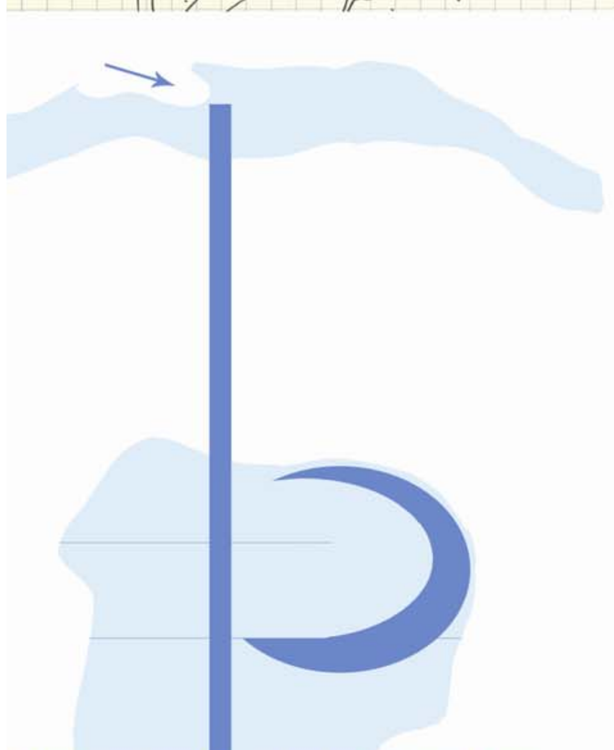


Detachable: This has the ability to hold an additional vessel, one that can attach/detach and survey any necessary area.

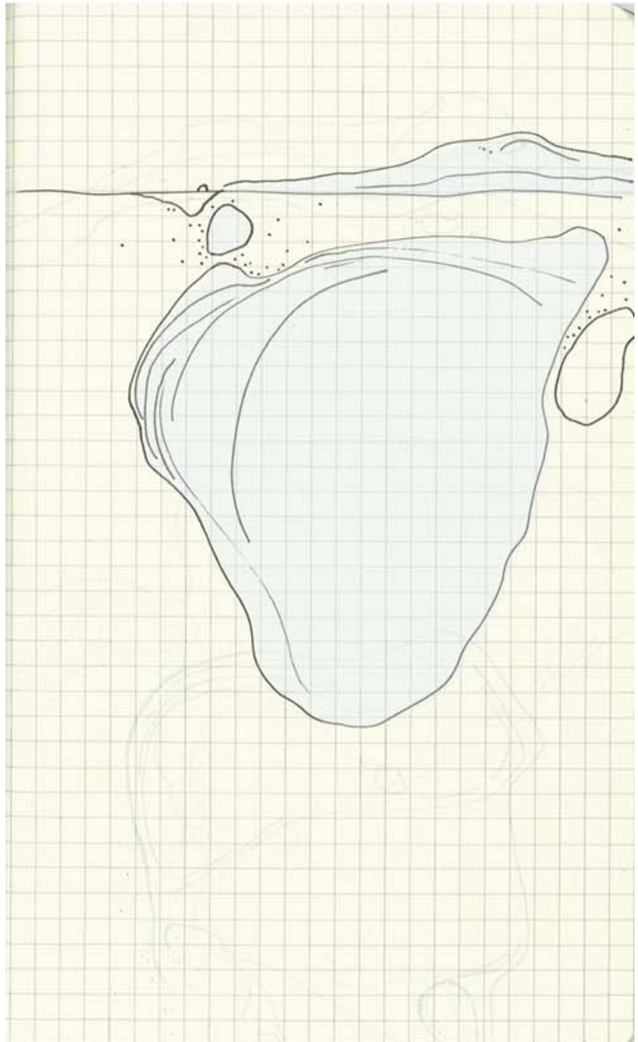
Void is Core: Bubble formations can serve as the core / circulation elements, connecting the surface to below.

*Can be read in either plan or section view.





Landstation: Requires vertical transportation to below. This solution is very similar to the Posiedon Resort.
Research Lab: Allowed to have direct relation to the outermost edges.

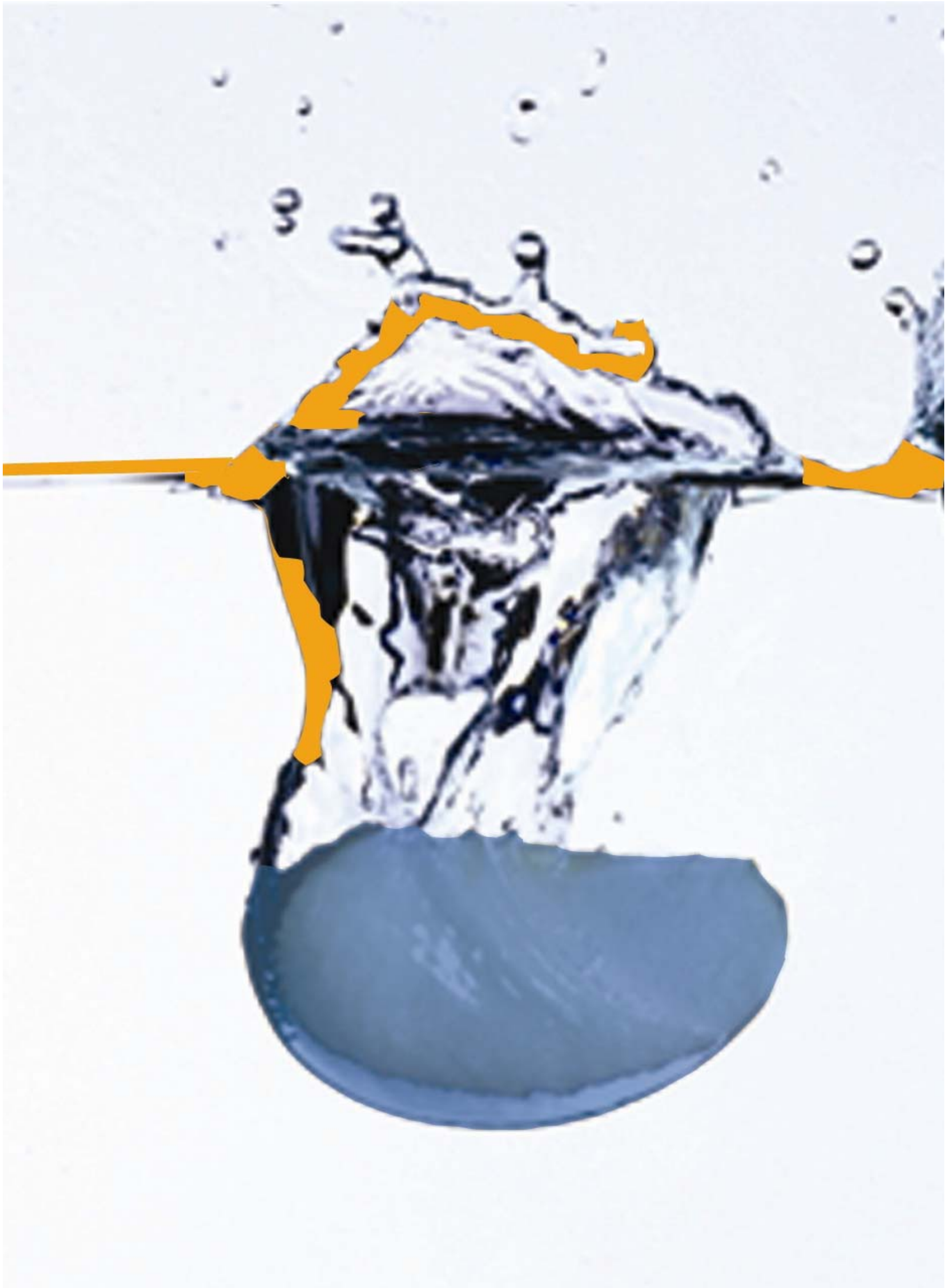


Exposure: The nearness of the lab to the water is highest.
Station Surface Area: With a convex arrangement of stations, the number and accessibility of each is heightened.
*Can be read in either plan or section view.

Drop.
In my mind, objects that were dropped into water at first were foreign to the surface, but then became accustomed to it. This instant between the two interested me, so I searched for something I could gain information from. I liked the idea of my facility being literally dropped into place, and what kinds of things would happen afterwards to the surroundings. This is after all what would happen when inserting a new submarine into the ocean.

The first thing I wanted to look at was the reactions above the water's surface, since I had just investigated what happens below the surface.

The ripples are also a moment in time, so I wanted to capture their characteristics as well as I could.



Human Figures.
Once I looked at how forms shape underwater, I began to investigate still images, once again, of human figures in water to see how they adapted or reacted to it. I knew that these images wouldn't do anything except to aid in my abstract thinking process. By just seeing humans in water it could begin to help me visualize and think about underwater habitation.

The general idea of humans occupying and living underwater is not a new idea, and in fact has been in the world's history for many centuries and eras. Covering 71% of the earth's surface, it is the one thing in our grasp that we haven't conquered yet. It is still much unknown.

All things unknown, or off-limits, are more intriguing and it seems that there is always an aura around them. Take outer space, for instance, a place that every country is attempting to conquer and race at being the first to achieve the next big accomplishment. The ocean hasn't been as successful for our technologies, and therefore, leaving it to the unknown. It is intriguing for me as well, being from the middle of a continent and not being exposed to it.

I also found it interesting to watch what happened to the fabric, and what kinds of forces were at work.

Wax Forms.

After seeing the series of these images, I instantly began to think of ways how to recreate these processes. As mentioned earlier, I would require a medium which was both liquid and solid so that I could capture the same things I saw in the abstract images. I knew these broad concepts were made up of stilling a motion, but was completely unaware of what I would find. These are movement within a single frame, visual explanations of directional flow within the water, proof of how the forms are shaped, and interior spaces that result when acting on the medium.

The process of evolution was an experience itself. As I began to pour heated, liquid wax into ice water there were many variables I dealt with.

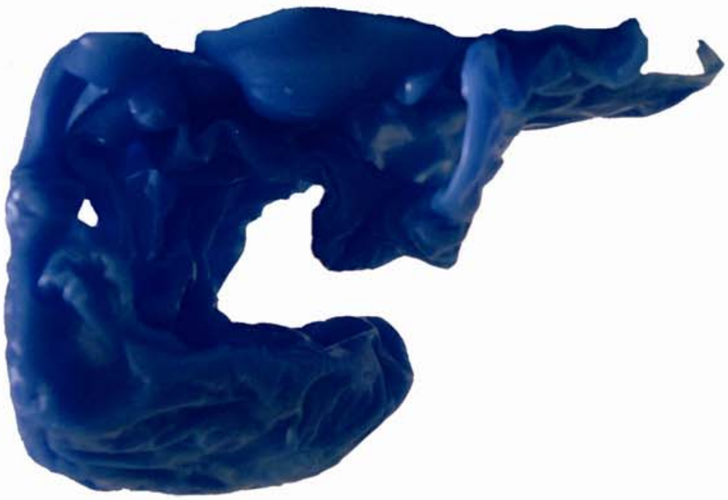
Speed of the Pour
Force of the Pout
Temperature of the Wax
Temperature of the Water
Amount of Wax to Pout
Pre-Heated and Pre-Solidified Twice
Consistency of the Wax
The 49 Different Configurations

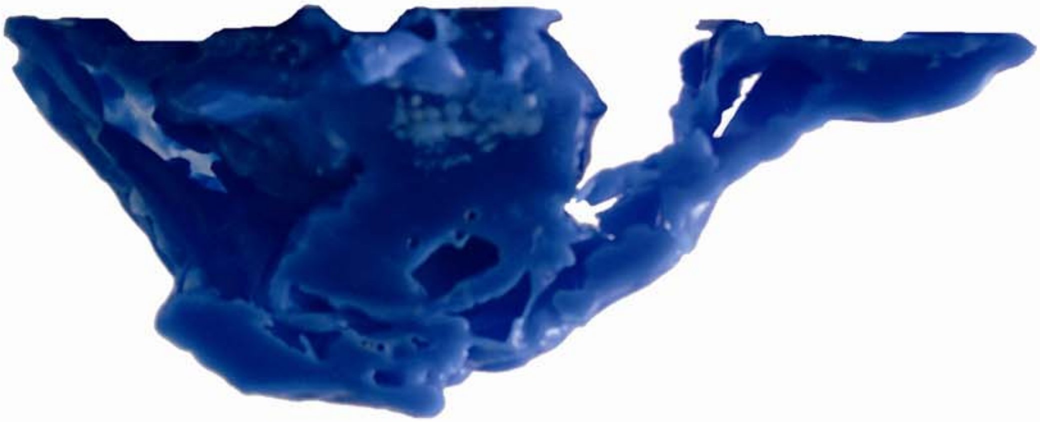
Once I photographed the forms from every angle, I started looking at them in depth to uncover all key points I could. My initial intentions were to uncover, by recreating the formation, how these naturally occurring events happen. I found the following things to be important to me and my project. I felt that by physically making an object I could understand how it was formed. I could also analyze the result just as I had analyzed abstract images not made by me.

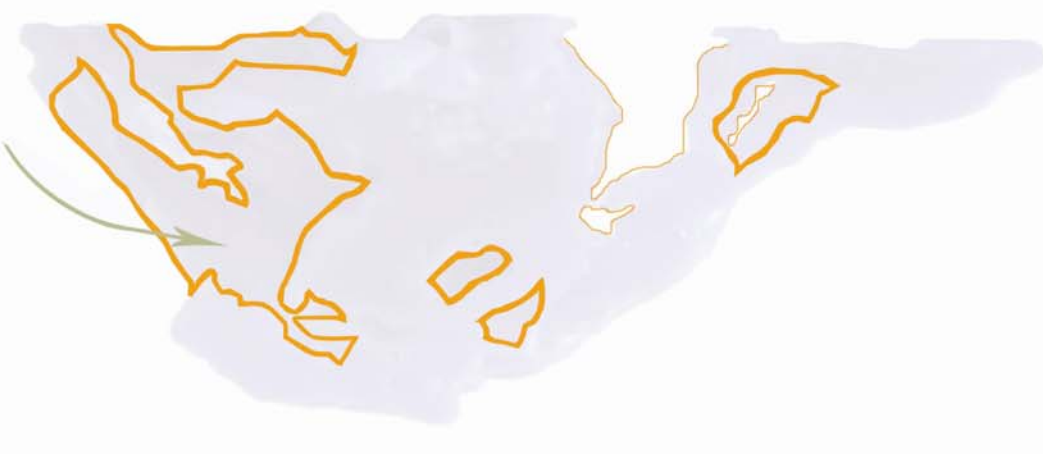
Directional Flow
Water Current Velocities
Air Cavities
Compression Forces
Wave Cycles
Air Bubble Influence
Form Indicator

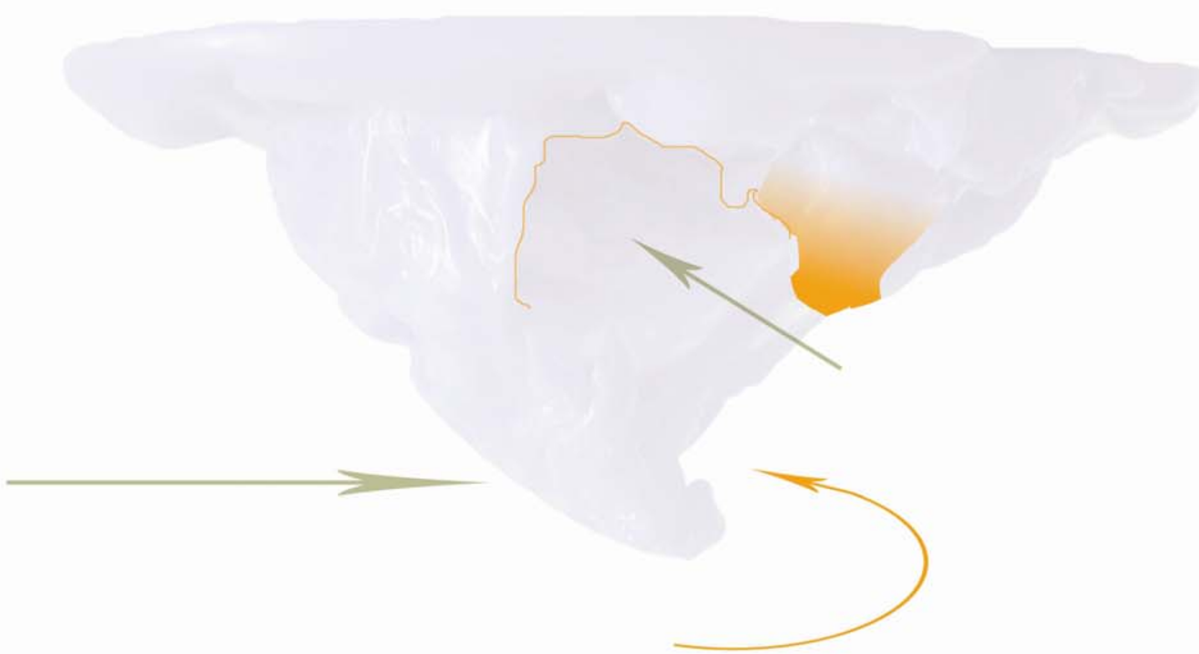
The following images show these by the use of arrows and color blocks.

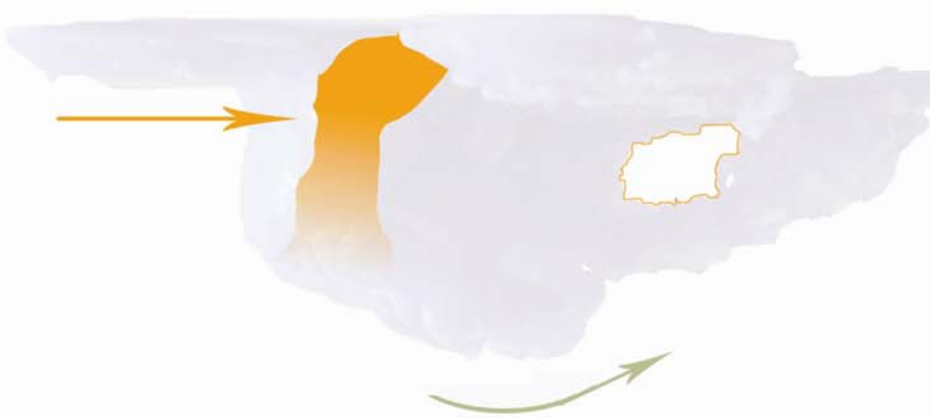
I held myself back from interpreting them as individual architectural pieces, by thinking of voids as fenestration or interior spaces, or by thinking of solids as an outer shell of the forthcoming facility. Rather I focused on their formation to help me gain information on how they were shaped. At the moment, my sight was perhaps quite narrow, and had I put more time towards additional techniques of analyzing I may have found far more answers in the wax forms.

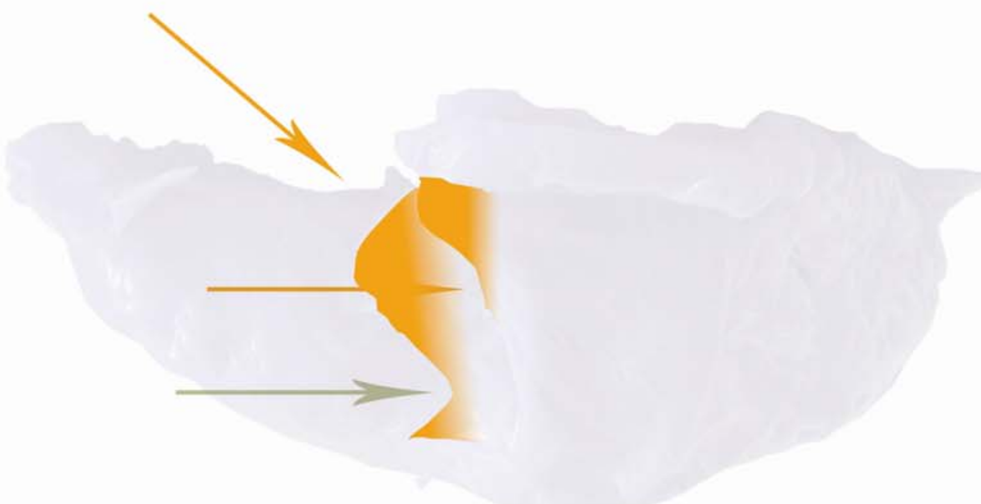












CDS.

DI D.

CONCEPTUAL DESIGN SUMMARY

The stage has been set for the process of my conceptual design.

I uncovered many new and innovative techniques for developing the conceptual design phase of an architectural solution. First I gathered all of the necessary research so that I had a basic knowledge of everything concerning the ocean and its properties. In a way, I gained an understanding of physical oceanography by separating it out into pieces. Each piece, however, was extremely critical for me to understand before I began conceptual design. They acted as restrains so that I wasted little time when thinking about the design of the facility. I knew what was possible and what could be pushed to the very extreme, with also knowing what was not possible.

With all of that information stored in my head, and adding the abstract imagery to the mix, I could focus on transitioning it into architecture.

DESIGN INTENTION AND DIRECTION

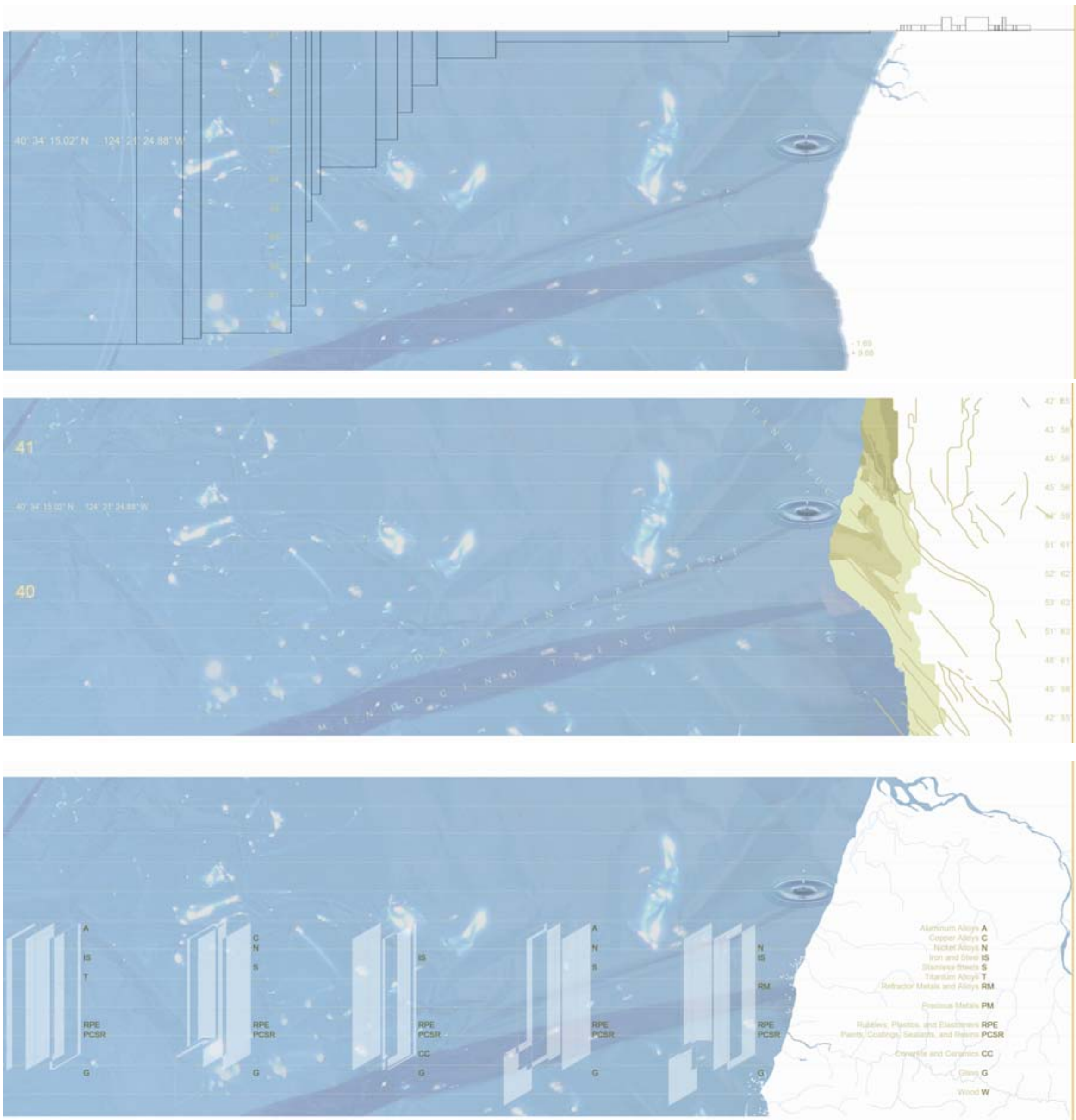
My design direction began as I was completing the conceptual design phase, but at a small level. As I provided architectural notation to my sketches, I kept track of what I learned and what kind of design elements I would want to include in my design.

These design elements include the following intentions:

_Maximum Observation Viewpoints from within and from outside
_Stabilization Mechanisms
_Its outer edge to contain [12] Research Stations
_Living Quarters to house [4] individuals, with enough Privacy
_Minimum Vertical Circulation square footage
_One View of the instance between the Air and the Water
_Detachable Pod for additional research

As you follow my design process, you will see each of these elements appear in the floor plans, sections, and perspectives. The interior spaces remain much more consistent than the form. The form goes through three main stages, the first being concerned with structure as the primary form indicator, the second concerned with abstract conceptual architecture, and the third with material application and tectonics. The previous series of images will come into play throughout the design process, and is advised to refer to for additional visual aid. Included are the interactive narratives per critique at each stage of the design process.

PD.



40° 34' 15.02" N 124° 21' 24.88" W
41
40
Aluminum Alloys A
Copper Alloys C
Nickel Alloys N
Iron and Steel IS
Stainless Steels S
Titanium Alloys T
Refractor Metals and Alloys RM
Precious Metals PM
Rubbers, Plastics, and Elastomers RPE
Paints, Coatings, Sealants, and Resins PCSR
Concrete and Ceramics CC
Glass G
Wood W

Process Documentation

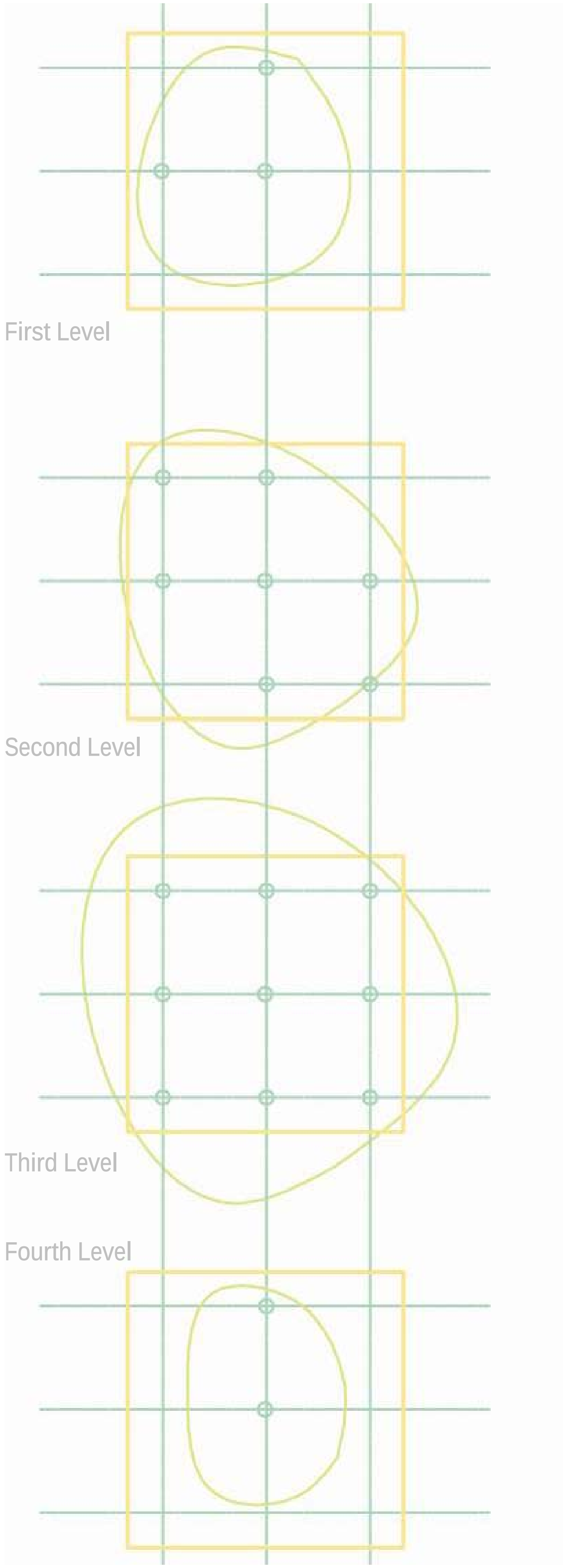
The beginnings of my design carried over ideas I had gathered from my summer independent course where I focused on materiality, structure, and environmental conditions of the site and surrounding area. Thinking very critically of the facility's performance, my initial sketches were very stiff forms with little irregularity and quite spherical in shape. With the material palette at hand, I created an early wall section of possible material layering systems that focused on performance and efficiency.

Presenting these ideas and information at my first formal critique, along with eidetic images representing the areas of my independent study course, I had a good grasp on what kinds of designs were possible in my given conditions. Somewhat limiting myself early on, I wanted to get a full and complete understanding of the basic forces at play before I began to look at the architecture so I could make educated decisions. I chose this course of action at an early stage of my thesis project. My other option was to begin right away with the previous images, and not rely on my newly gained information until the end of first semester. My final product would be very different with either path.

But similar to a typical design project, I began with basic and necessary information. Site details, site section cuts through the ocean, and materiality were among the few that I had. These things plus any alternative feelings about the location, design topic or program requirements combine to form some kind of abstract concept idea. The concept I felt strongly about was related tightly to my original idea; Research at its Closest Proximity. My goal was to design a research facility that was at one with its' subject, the ocean, and it would do that by taking inspiration from *other* natural objects in the ocean. Another goal of mine became realized when I had to challenge myself to combine various areas of topical research to produce an architectural project.

Choosing the path where I began looking at materiality and structure quickly, then within one month moved on with that knowledge gained, and focused on abstract ideas to apply to my conceptual design.

This is the process I took, and the process that will follow.

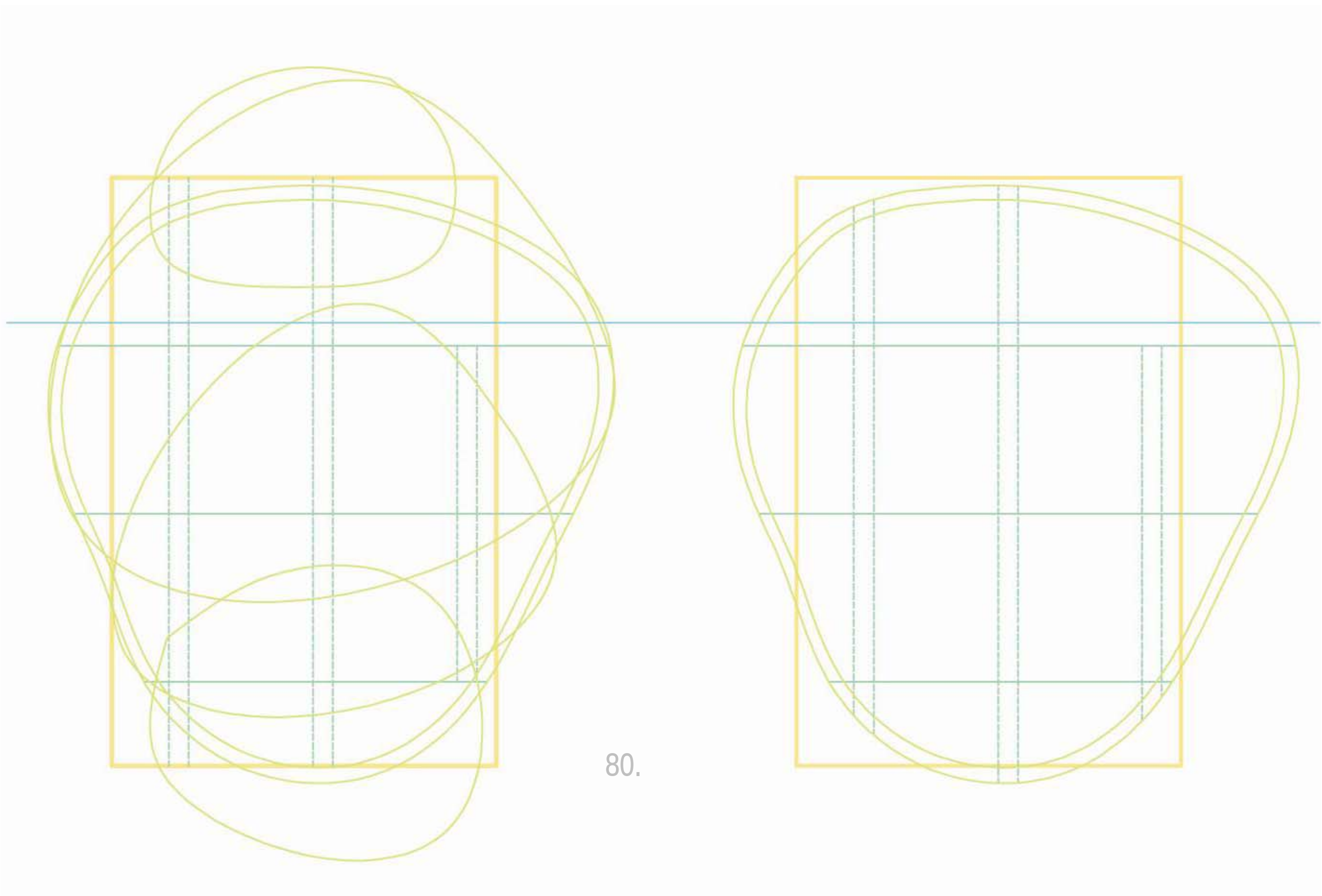

First Level
Second Level
Third Level
Fourth Level

As I worked through the first semester of ARCH 613 I produced very early, and very preliminary forms that were primarily based on structural needs and materiality applications. I did not try to concern myself with form at this point, or focusing on the expressiveness of my conceptual ideas. Rather I was still in a state of tectonics following my compliment of documents from the summer work, all of which can be referred to at the end of this book.

The dates represented here are from August 2007 to the middle of October 2007.

The floor plates and sections shown here represent the mind set from above. No program had been added at this point until my first critique had occurred, but instead I looked intensively at structure to get a grasp of how rigid it needed to be. Introducing elements I had gained from my case studies was happening here as well. Again, just laying the foundation was my initial plan. As I looked at submarines, noticing their sleek bodies with little variation from straight lined-forms, my drawings began to mimic their overall characteristics by adopting smooth lines and curves. I also developed a grid pattern for myself to work off. Spaced 12 feet apart, I was aiming for a rigid structural system that would hold up in the rough weather systems that passed through my site. The orange box represents the extents of this structure, with the curved line acting as the encasement or skin. Below, a shell starts to become noticeable which wraps around the structure. In these images, the water line is first seen as well.

Once I felt like I had accomplished what I set out to do, I moved on and prepared for my first critique. This review would send me on a path headed for more conceptual designing.



As I fully understood all things structural, material, and sectional, I then turned to more conceptual thinking. I had, after all, all the necessary information to make my research facility perform once I had developed its form and overall design, so this step was the natural one to follow.

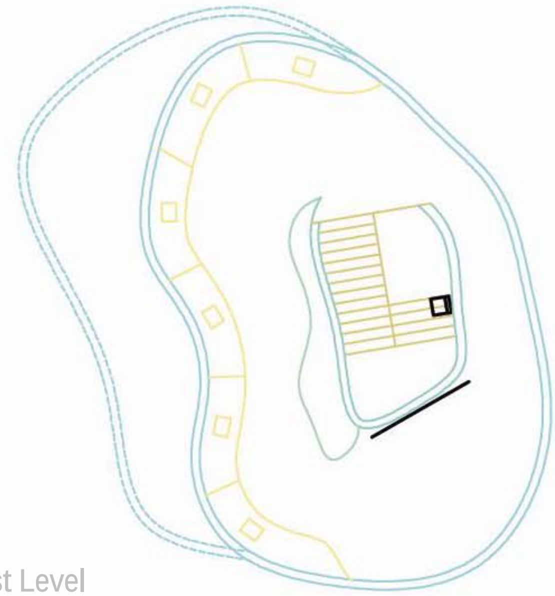
The dates represented here are from the middle of October 2007 to the end of November 2007.

The first thing I did once I had my critique was decide to search for inspirational images, as I would do in earlier years of school, to find something that caught my eye. I began to look for images and instances where it showed naturally occurring events, all while happening in one single moment. As I gathered these, I began to sketch ideas about what a form could look like and what characteristics it could have. The forms I developed were very organic and irregular as I was trying to convey the motions of the ocean with the linear curves of my facility in both section and plan.

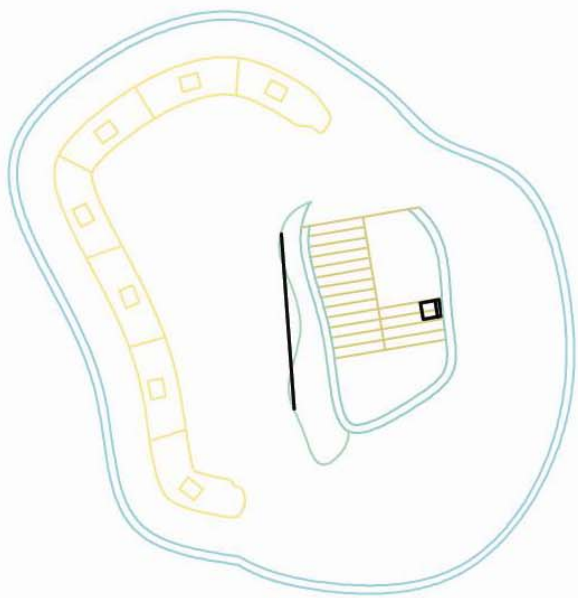
To the left was my attempt at recreating a compositional image that showed the organic nature of my floor plan as if it were a bubble itself rising from the bottom of the ocean. The small reflection beginning at the bottom slowly grows to become the research lab area within the facility. It becomes large enough to contain the correct amount of floor space as I had found to be adequate from my case studies. The resemblance from this image to my proposed floor plans, at the time, is unmistakable.

In the previous design, the facility had not located itself within the water. I had not looked at whether or not it would be exposed to the air, or if it were to be completely submerged. At this stage, which can be seen on t he following pages, the facility hovers at the water's surface. This decision was based on my choice that I didn't want the facility moving too much within the site. I had, after all, spent a large amount of time and expenses locating the exact site I felt was perfect for my project in Northern California's Pacific Ocean. If it were completely submerged I felt that it would only make sense for it to be able to travel more. If it weren't then it became more ideal for it to be somewhat rigidly located.

Early on, my first sketches were of both plan and section. I was only concerned with form and form alone. I would eventually start to add and insert in programmatic requirements in the locations that made sense and alter the form when necessary. During this stage of my design process I was intently analyzing the abstract images and sketches from earlier to get inspired.

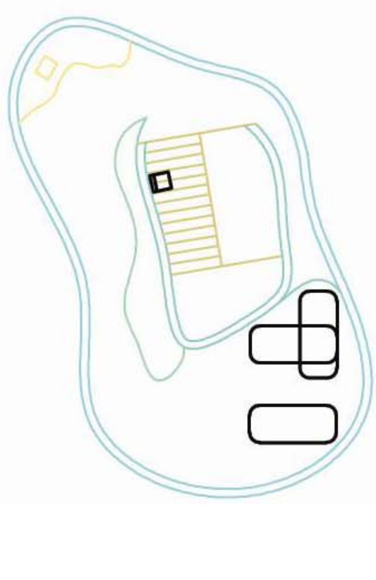


First Level



Second Level

Third Level



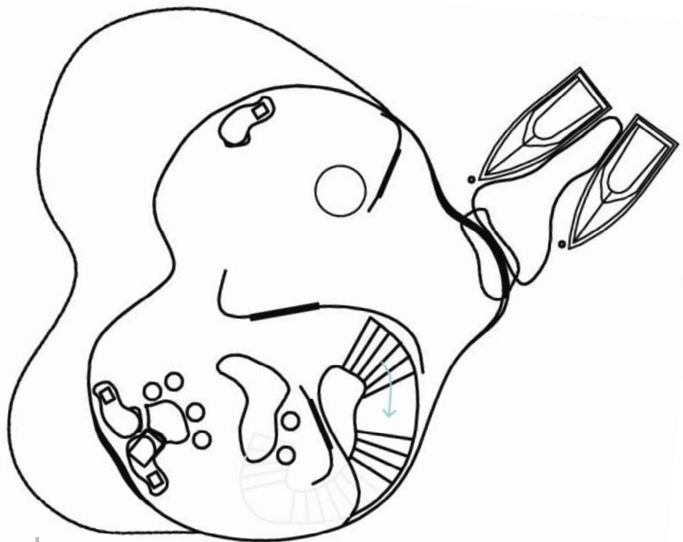
In this initial layout, a number of things are obvious.

The floor space and area that the vertical circulation takes up are quite large to the area of the entire structure, and dominate the section. Stairs were my immediate thought when discussing vertical circulation, but they weren't efficient for my small facility. They also do not relate very well with this facility being in water, as if this could have been place anywhere. I felt like I had a good form direction, but the interior spaces weren't pairing up with it very well. I was happy with the shell I produced because it did quite a lot of things I was trying to achieve.

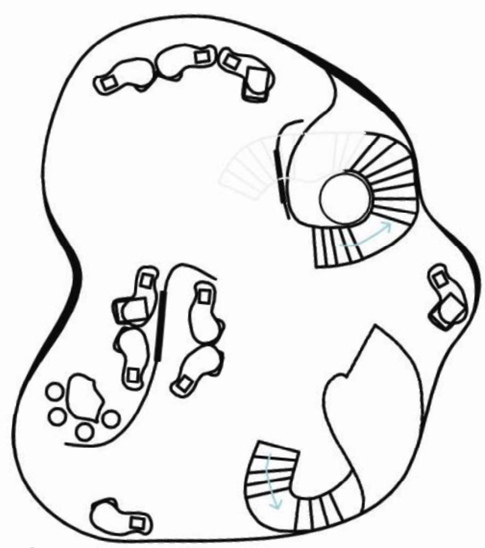
_It gave me optimal viewpoints throughout the facility, as well as from the interior.
_The concave portion below the surface imitated what I had uncovered about how underwater objects form and what kind of forces are at play. In this case, the current velocities dictated the placement of this element.
_It produces the visual line between the air and the water.
_It easily contained any kind of structure that I would insert in.

The concerns for me were more about what I could change from the interior and still have the shell form remain constant, or somewhat constant. Everything on the interior was to alter in order to relate to how this facility adapted to its surroundings.

Items that needed attention were the stair case, locations of the research stations, stabilization measures, introducing a research pod that could fall below and survey deeper depths. The stair case was only an option of a type of vertical circulation, and I would eventually inquire mechanisms that took up much less space. I wanted this movement between the floors to be an experience, and I wanted its inhabitants to move slowly and realize the distinction between above ground to below water. Stairs gave me this feeling of space, but I could get the same effect with a transparent or glass elevator. The orientation of the research stations were pushed to the outer edge of the facility, all facing towards the west, or out to sea. As physical oceanography focuses on observation systems, I chose to make the researchers have views outwards from within the facility to their subject.

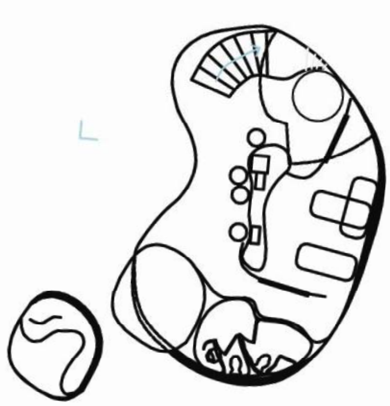


First Level



Second Level

Third Level



My goal to end the first semester was to develop in depth floor plans and sections that each achieved the items from above, and building on what I had.

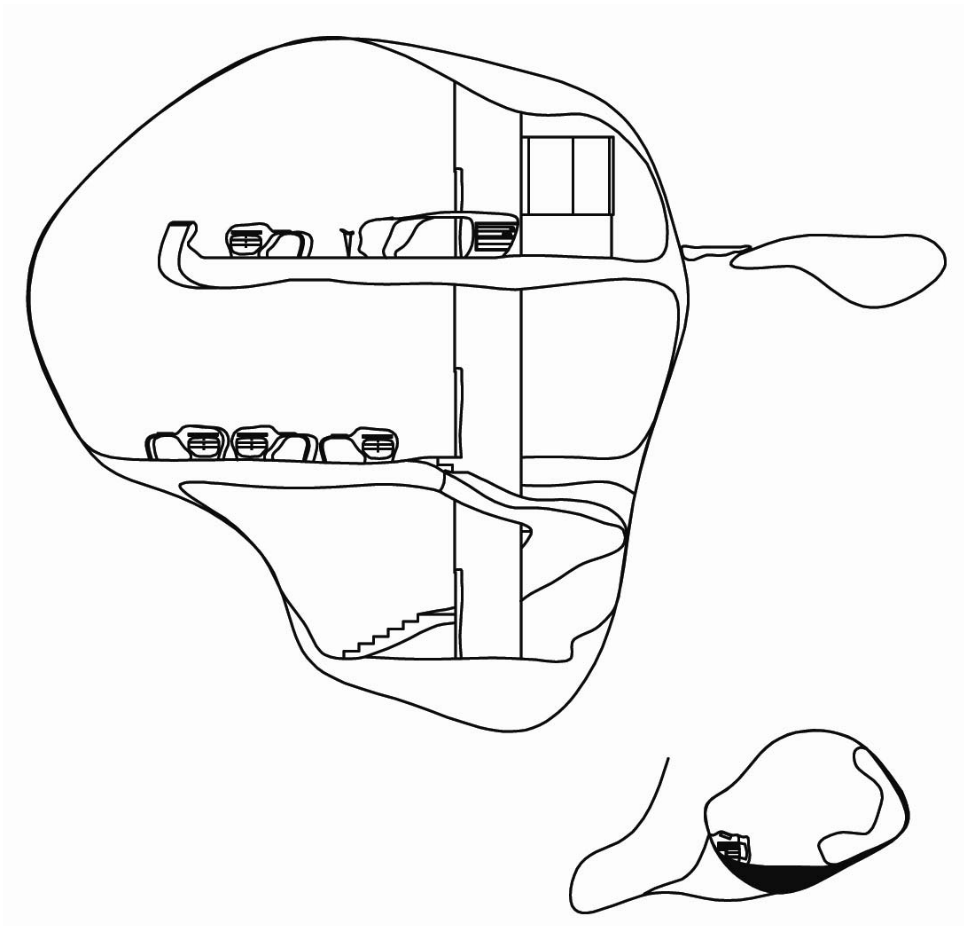
The dates represented here are from November 2007 to the middle of December 2007.

The most noticeable additions from the previous include an entry system, means of transportation to and from this facility, refined vertical circulation in the form of a winding organic stair and small elevator, the introduction of moveable and flexible research stations, stabilization mechanism, and a detachable research pod connecting to the lowest level. An overall change also lies within the shape of the outer form. It has developed into two conical shapes that look outward and provide the researchers with more viewing angles of their subject.

As I began to think technically about the means of operation, I determined how inhabitants would reach it. With a three minute, mile and a quarter, boat ride from the coast off Ferndale's Centerville Beach. Two boats are necessary for the maximum human load capacity. The actual boating dock would perform dually as a dock and a stability arm to the structure, aiding in any rough weather conditions. This can be seen in both plan and section. The other part of stability comes in the form of tension cables that reach from the lower third of the facility to the ocean floor. This keeps the facility within the desired location but gives it enough movement to interact with the ocean.

The previous stair case has fragmented itself and adopted a similar language to the outer shell and overall organic nature of the entire project. As it winds down between each floor it passes just along the surface of the glass which achieves my desire of having this circulation become an experience. At the lower stair, the shapes wrap around the elevator shaft. You'll notice the placement of the elevator is not in the center of the floor plan, and this will alter when I apply structure to the facility. At this stage, however, it aided in the allowable space for the furniture to be as flexible as possible.

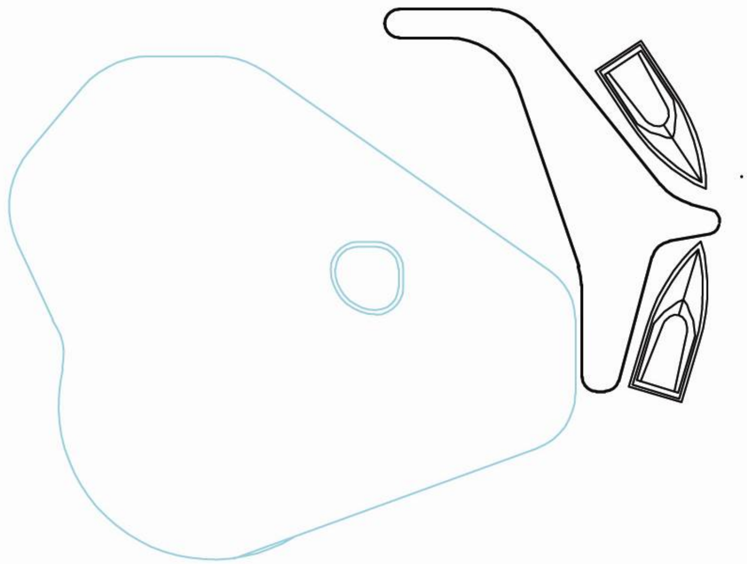
The 12 research stations have emerged here as individual desks that combine into multiple configurations of orientation. Within the stations are several display surfaces that are also moveable. The layout of the entry level was designed for a more display and discussion function; with the middle level primarily research only. The ability to move around within the facility and be able to create groups is a great addition to the research.

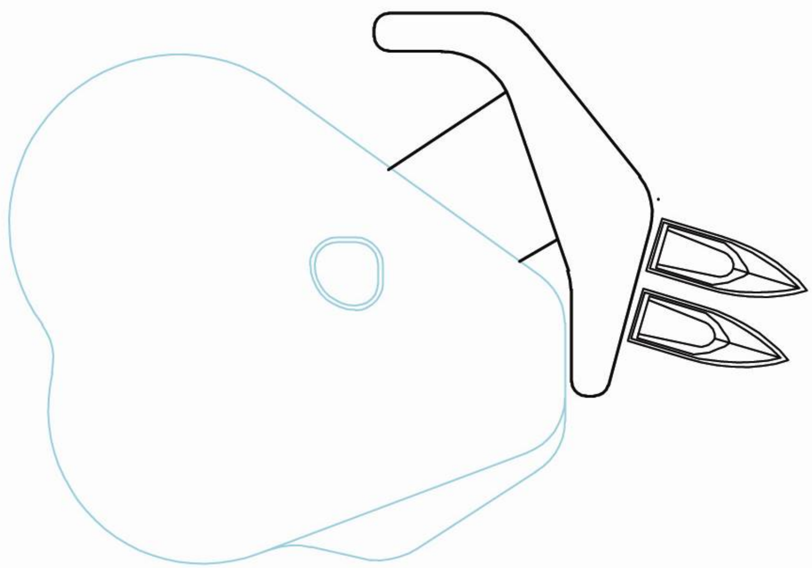


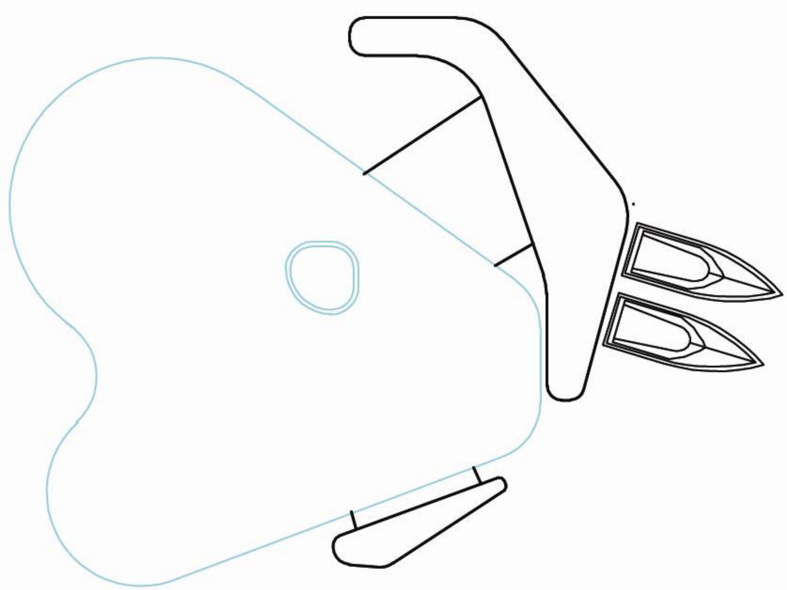
The addition of a research pod was inevitable. From early on, I had envisioned this kind of extendable lab that would be able to probe deeper and further into the ocean. The optimal location for its attachment and detachment was on the lower level. I thought it would be vital to continue my original idea of being completely submerged in the study to add this type of extra space for research. It also adds a new and interesting space to this project by imitating a typical submersible. The typical space can all of a sudden become intriguing space where two individuals are completely and utterly in touch with their environment and their subject.

To comment on the overall form, the final shape is beginning to develop here. As I came back to look at the definition of physical oceanography, I knew that observational systems was one of two primary ways the research for this field occurs. I wanted to play with this idea, and add to this half of the research. It manifested itself as the extrusion of two domes or conical shapes that reached outward to produce the maximum surface area of connectivity between the two elements; the research inside and the research topic outside. The most surface area occurs in this moment where the water surface touches the air, and ultimately diving in the ocean as it lowers on the facility.

The spatial layout is dominated by its majority of space dedicated to research activity. This apace is fully dedicated to the upper two levels exclusively, leaving the bottom to others. It was key that the two research floors be visually connected to either other and to the subject. The bottom level is to be primarily living space for the inhabitants as they stay for multiple days at a time.





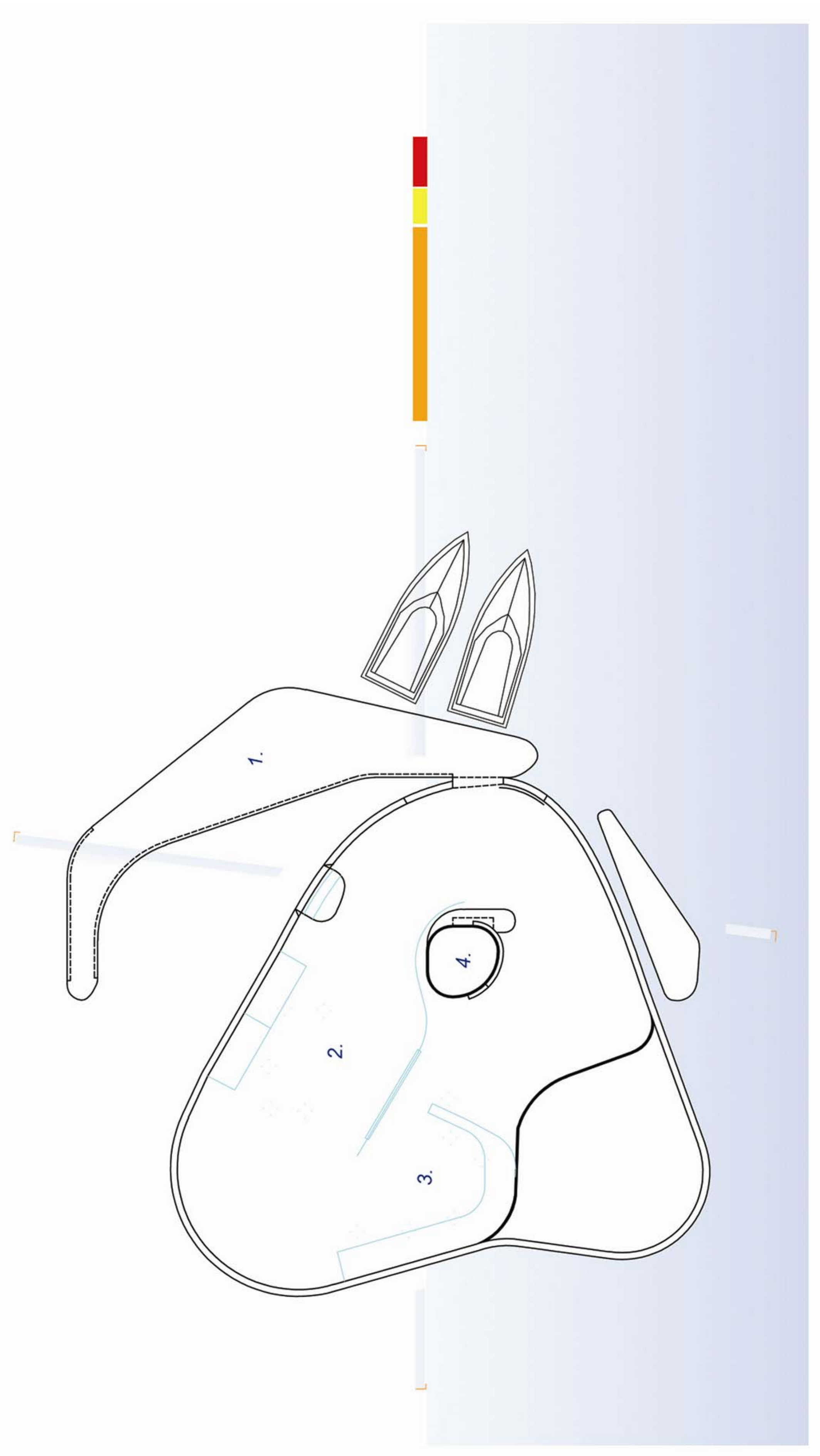


After first semester ended I began right away in preparing for second semester's work load. I focused on refinement in all aspects, and began with the form which reflected in alterations in the plan and sections. Other areas included making the design work technically, structurally, and developing power options.

The dates represented here are from January 2008 to the beginning of April 2008.
The following images reflect the design I completed in April of 2008.

The most noticeable refinement takes place in the overall shape of the form, as mentioned above. They have resulted because of the application of materials, structural analysis, and basic refinement from the previous semester. The different stages of shape I went through can be seen here. Each holding the similar elements I felt necessary to carry through to this semester.

My process through second semester was firstly concerned with form, but once I reached a solution it went towards its performance. For this reason, I will proceed to go directly into my final design documentation.


1.
2.
3.
4.

The floor space contained by the first, entry, level has remained the same size as the previous floor plans shown. The things to notice are the sizes of each interior program, as they have changed and developed to better fit the facility. Here the bright color blocks represent the program on this floor alone. And will do so on following floors.

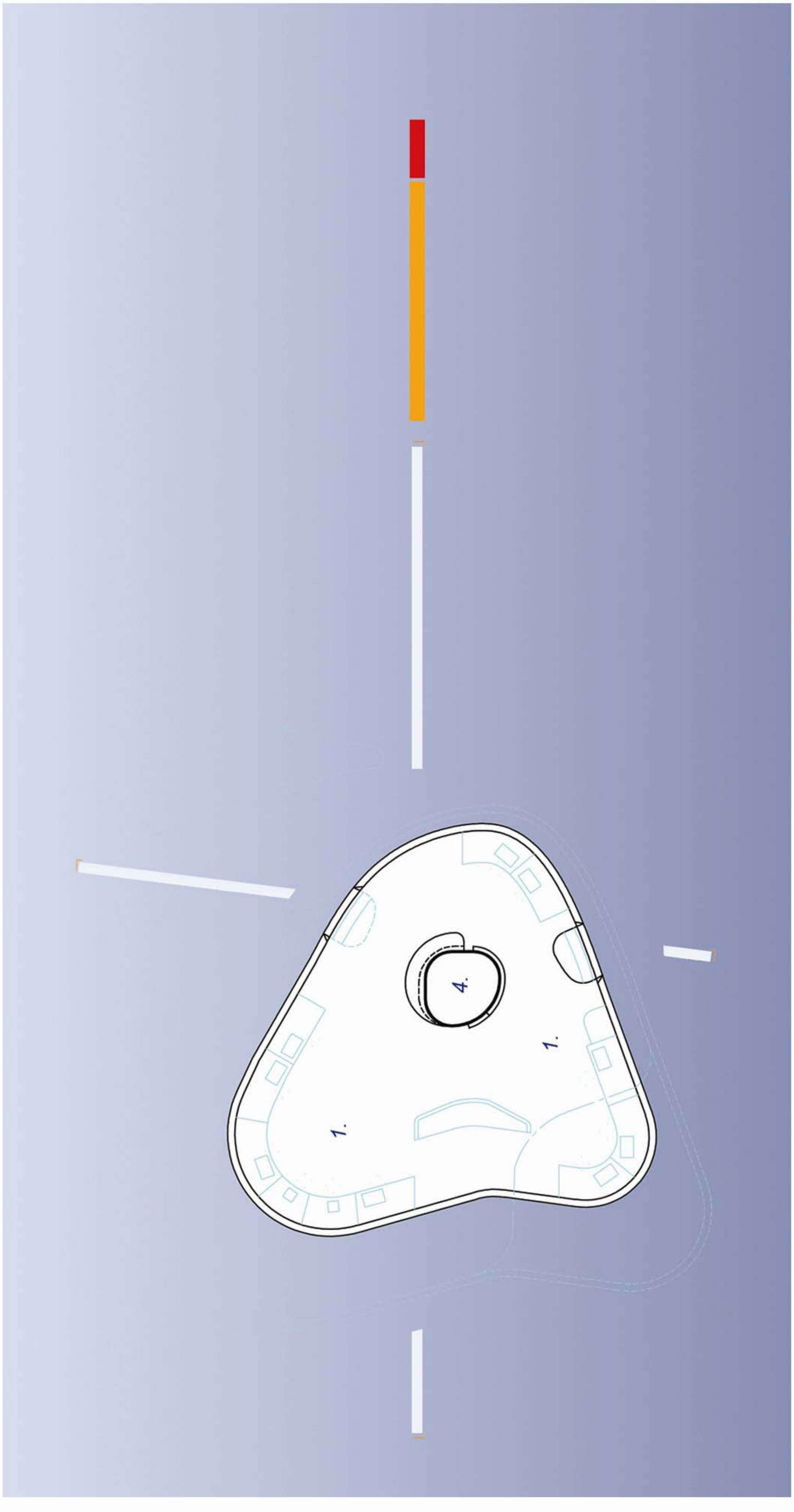
Orange denotes the area containing Research Activity
Yellow denotes Support Spaces
Red denotes Circulation

Form.
The same elements that have remained are the gesture of two outward-facing domes of observation. There are three, counting the larger of the two facing the entry, of these elements and all have been accentuated in their size and form. The irregularity has been hammered out to become very much streamlined, and had to in order to be able to apply the materials I chose. This would be one instance where I could have made a different turn in the design, and not concerned myself with the realities of this facility being built but instead constructed an elaborate form. A form that, we can say, mimics the wax sculptures.

Stabilization. [1.]
The size and length of the stability measures has grown to comprise more of the surrounding space near the facility. There is also one additional stabilization arm. The function of the larger has not changed, in that it still acts both as an entry system and as a stability mechanism. It has, though, acquired a new function. Now it can be utilized as another point of observational research if one were to stand on the peak guarded by rails.

Vertical Circulation. [4.]
The glass elevator is still constant, but has moved to a more centrally located area within the structure of the facility. Now acting as both circulation and structure, it can perform at a much higher level. The stairs have been removed, and in their place sit small ladders which attach to the titanium mullions. This type of circulation gives a much closer experience of the contact between the researcher and the subject. The ladders act as a secondary means of circulation, with the elevator the primary.

Layout.
After the three minute, or mile and a quarter, boat ride to the facility from Centerville Beach, you will dock the boat and step onto the entry bridge that is also the largest stabilization arm. The door you will use slides to the left and you pass through the 8 inch acrylic into the FoPOR; Facility of Physical Oceanography Research. The atmosphere you will encounter is one based on observation outwards and attention inwards. The views are all around you once you walk past the information desk and past the elevator. By walking to the left, the visual connection is felt between the two research levels as the floor drops out from underneath and the sight is open to below. The line of vision here is also to the threshold between the water's surface and the air. By walking to the right, however, the discussion and display [2.] of research can be found. The stations are turned inwards and facing the dual-sided presentation board.


4.
1.
1.

The programmatic layout of the second level is majorly research, and the necessary accommodations for vertical circulation in the form of the elevator and the two, now, ladders.

Orange denotes the area containing Research Activity
Red denotes Circulation

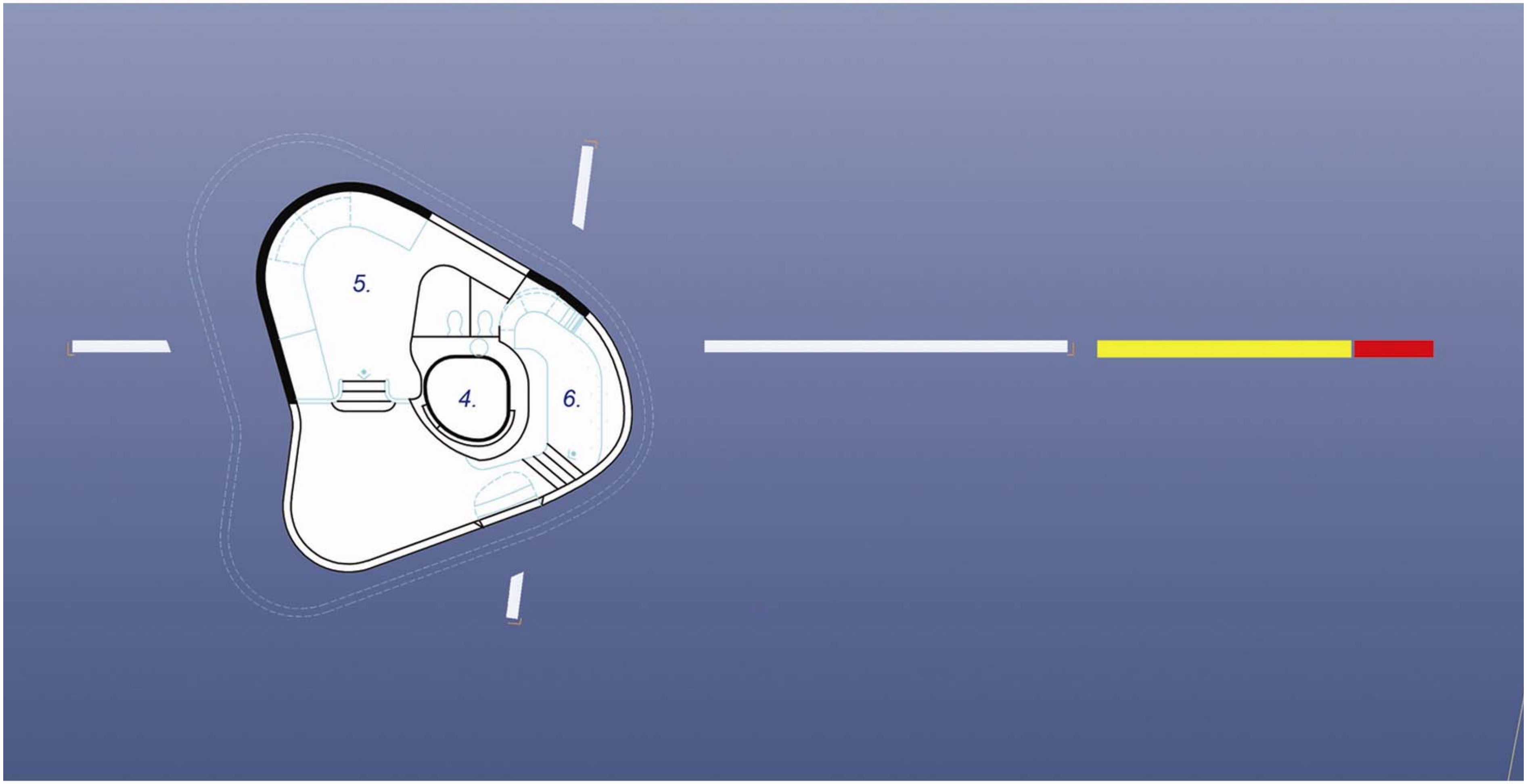
Form.
The same elements that have remained are the gesture of two outward-facing domes of observation, but on this level they are actually larger in size than the prior. As a research dominated floor, these observation points had to match the intensity of the behavior around and within.

Circulation. [4.]
The same elevator punctures the light weight concrete floor plate, as do two ladder locations, with one traveling upwards and one downwards. On the side of the elevator, a small wrapping bench provides rest during a day out at sea. It has been oriented in this angle to achieve a somewhat more private space.

A second, longer bench is also located within the research stations to the west.

Layout.
Entering the second level below sea level, you will come by way of two types of circulation. Either you will chose to climb down the ladder, during which you'll get to experience a slower and mechanical decent where the closeness between you or the ocean cannot be closer. The view after you turn around will be of the bench as it wraps around the elevator shaft. If choosing to ride the elevator down one story, as the glass door closes, the ride is somewhat quick but the time spent taking you down through the threshold of being above water to being below water is worth it. In the elevator each person is in a sense standing within two transparent shells. The view after the door reopens is one where you can see the floor above you end with the water's edge is visible. Both choices now can appreciate the amount of research stations [1.] and the focus driven nature of their orientation. Each is positioned to face outward into the water.

Power.
The research stations will house individual laptops, each to be powered by the facility itself. These power outlets will be discussed in further detail.



5.
4.
6.

The programmatic layout of the second level is majorly research, and the necessary accommodations for vertical circulation in the form of the elevator and the two, now, ladders.

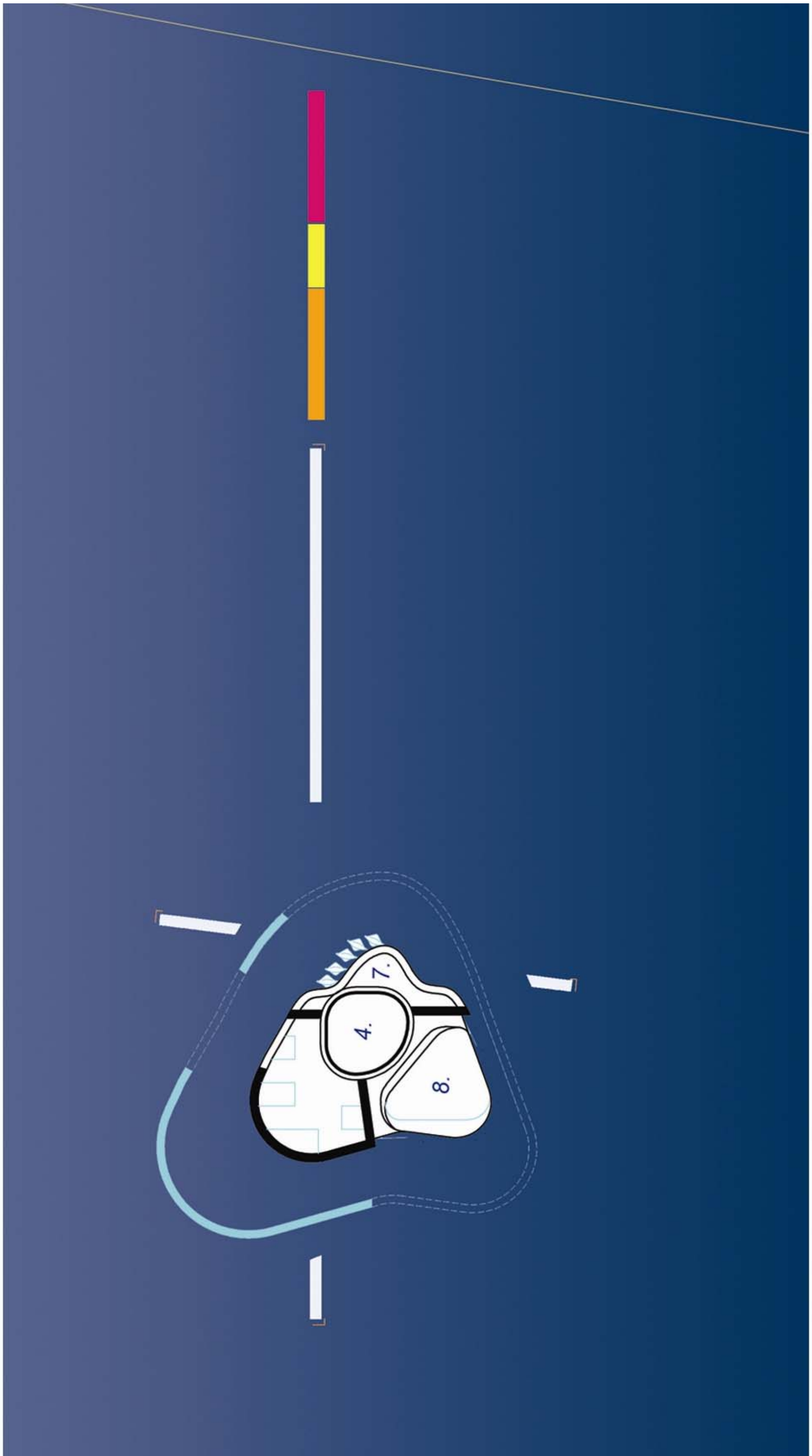
Yellow denotes Support Space
Red denotes Circulation

Program.
The program on the third level is quite different from the previous. The plan itself can indicate the initial differences. As the elevation becomes deeper within the water, the less observation is needed by the researchers, and now becomes the necessity of living spaces [5.] and a kitchenette [6.]. The living quarters can sleep four average size men in bunk beds, with the additional sleeper sofa in the center. This space is sunk down from the common space and the elevator. It does this for added privacy and a separation of spaces, as the living quarters showcase a hallway to the restroom. The hatching seen on the plan also gives a hint to the type of window condition in the living quarters. There is an operable fogging system where a switch can be activated to fill the space within the glass and acrylic with fog to provide a desired amount of light privacy. On the other half of the plan, the level is also sunk down from the main space. The kitchenette requires a thick wall of program to tie into, so the electrical outlets that power the appliances can be connected back into the main system that travels up through the elevator core. The kitchenette allows for multiple type of seating, either on high tops or lower padded benches. The central common space is a temporary space in between the two main functions of this level.

Power.
The appliances located in the kitchenette are also on the same power grid as the research stations, and are self-powered by three different options. To be explained later.

Circulation. [4.]
The elevator remains present, but is in pairing with two new stair systems. Each stair is made of four risers and fall down into the respective spaces to create a different mood. Allowing a level change does two things for my design. One, it produces a new perspective to ceiling heights not yet introduced in the upper levels, and two, it makes way for the vertical space the Research Pod will take up when in its attached position directly below the common space.

Layout.
As one enters the space just outside of the elevator doors, they are greeted with the view of the ocean once again, and as they turn back around are faced with two entries, both down into both of them. To the left are the living quarters that seem darker as if the fog mechanism is on. The right leads down into the kitchenette where it is much more filled with light as the acrylic is left open to the environment. The high top table seating is right against the window with the appliances across the room.



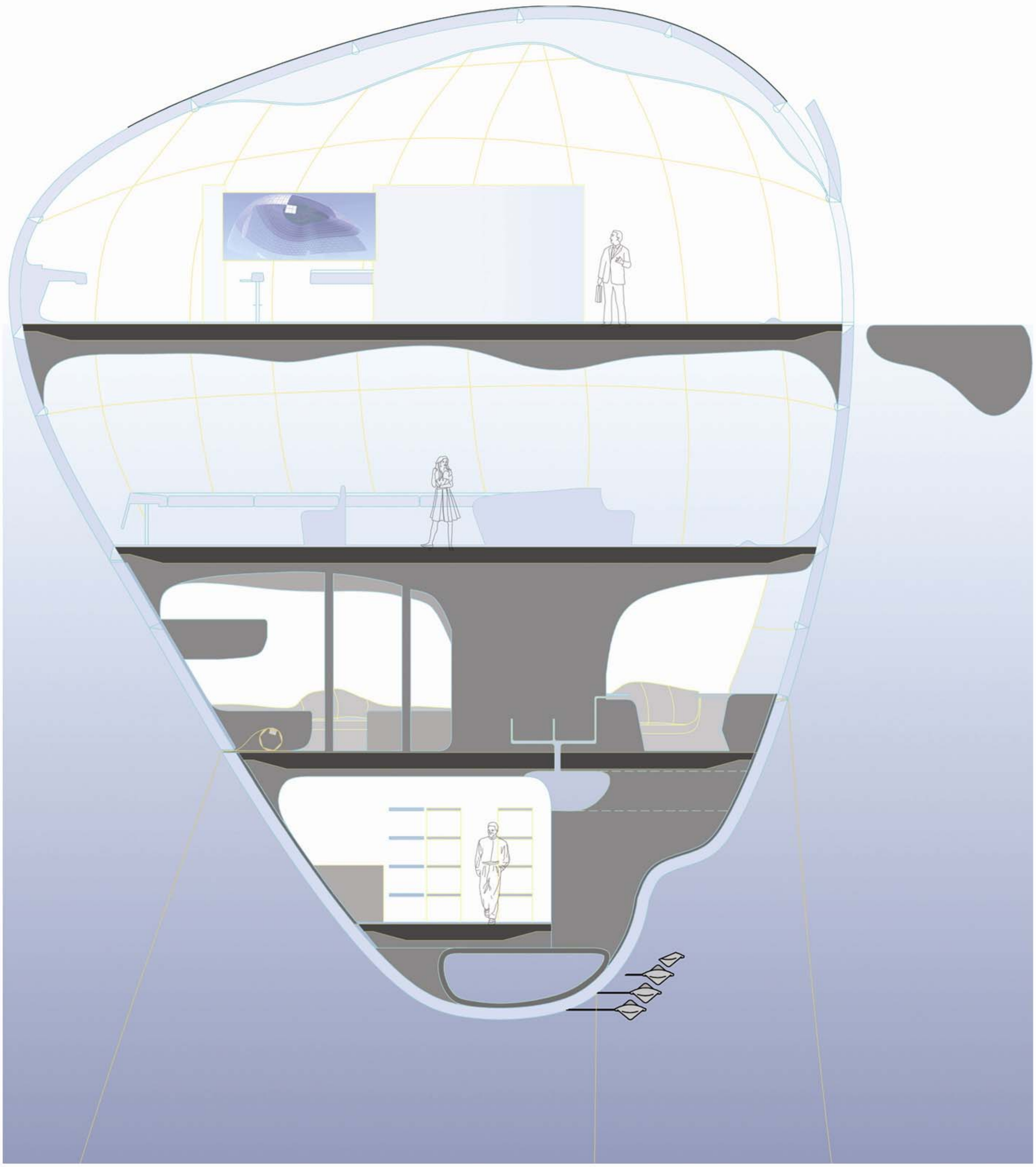
7.
4.
8.

The programmatic layout of the second level is majorly research, and the necessary accommodations for vertical circulation in the form of the elevator and the two, now, ladders.

Orange denotes Research Activity
Yellow denotes Support Space
Pink denotes Efficiency Mechanisms

Form.
The form and shape of the lowest level coincides with the tidal velocities approaching this elevation within the ocean. At this depth, a tail is formed by the shell to create more intense flow around the water turbines that help to produce power to the facility along with two other sources. This tail separates the programmatic function as well. On the opposite side of the elevator two independent rooms form, each with a different entry point from the elevator. The elevator will open to both. The larger and more enclosed space is designated for storage of physical oceanography plots and research documents. The other contains the Research Pod.

Research Pod. [8.]
The Research Pod is located on the lowest level of the facility for easy access of both detaching into the ocean and attaching back to the structure. It is designed for two individuals to operate at a time, and will enter through the elevator doors, and an additional pressurized door.



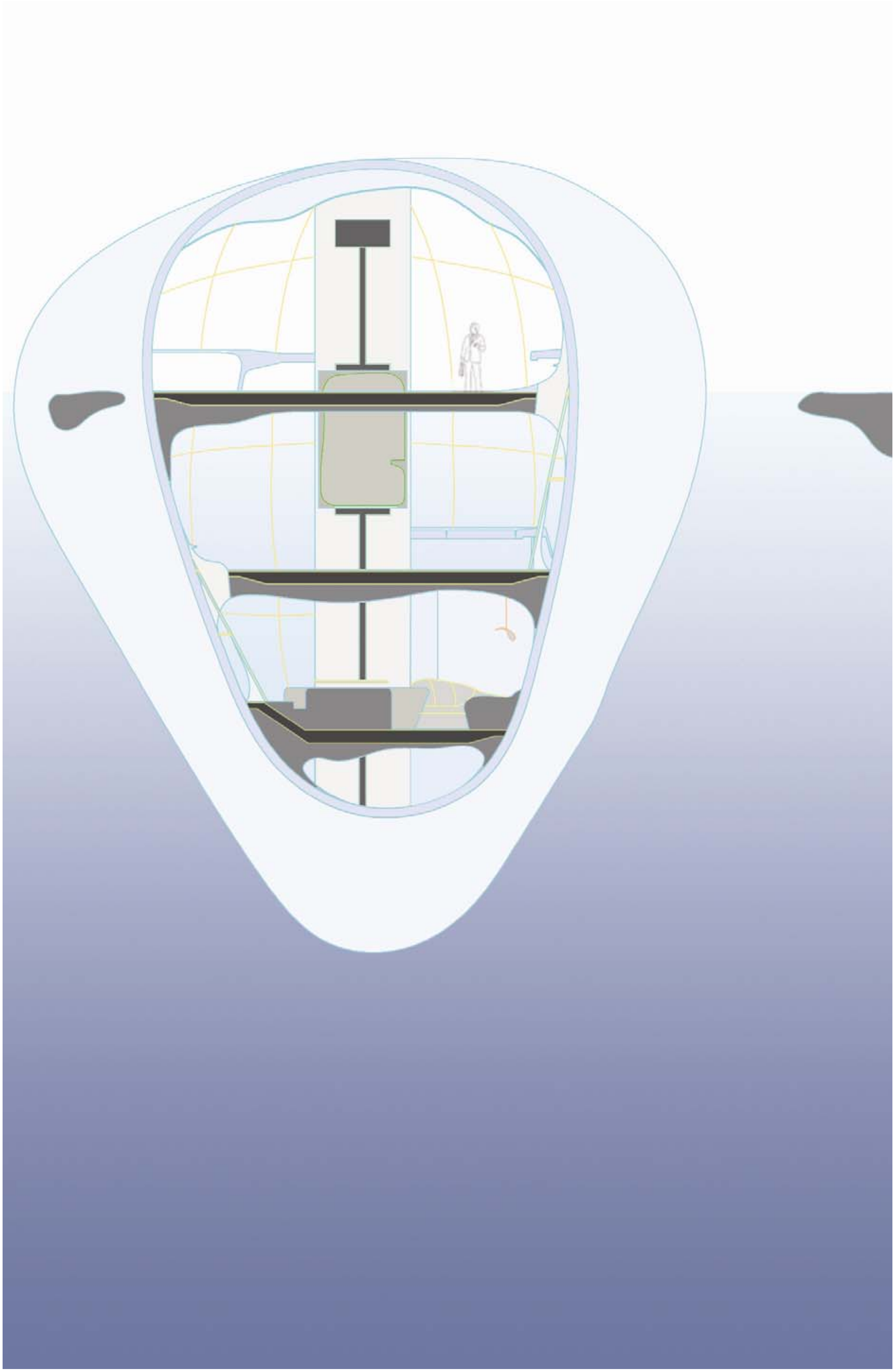
The aesthetic of the section, adopting many more streamlined lines and dismissing irregular ones, has changed to refine itself as it takes on materiality. The irregularity hasn't gone away completely, and still remains on the interior surfaces.

Form.
The form refinement is due to the 8 inch thick acrylic sheets that are applied to the entire surface area. The maximum amount of observation is still on the upper two research levels, with the lower ones more solid. As the facility reaches lower, the indentation where the water turbines are located is due to the increase in tidal velocity and therefore an increase in turbine acceleration.

Program.
Here the programmatic layout is much clearer to see, as the behavioral activities can be identified. On the entry level, a display surface and research desks are visible to reiterate the level focusing on discussions and display of research material. This level also indicates the amount of open walls to reconnect back into the aspect of observation. The level just below shows similar items. The observational qualities are even more present here. The research stations are spaced evenly across the far wall and faced outwards. As you get deeper in the facility, the program switches to non-research. The third level below is primarily comprised of common space made up of living quarters and a kitchenette. This section cuts through the housing for the plumbing systems to both the restroom and the appliances. It is also in this level where an additional stability mechanism is located. Just underneath a bed, a automated system is located that retracts or lets out cable if the degree of level is off by more than 5 degrees. By moving the cable entry points upwards on the structure it has also helped with the stability, as prior to this the cables were located on the fourth level below. This fourth level is now home to storage units. The solid voids now allow for space for the water purification and water holding systems.

Structure.
The structural system is quite easy to understand by investigating the section. The acrylic is structural and in between the sheets sit titanium mullions that also add to its structural stiffness. Titanium is also the only metal known in aquatics to be resistant to salt water corrosion. The mullions then latch into the light weight concrete slabs which are nothing more than spacers strong enough to hold the program on each level. They are not structural to the entire system, but act as structure to the live and dead loads.

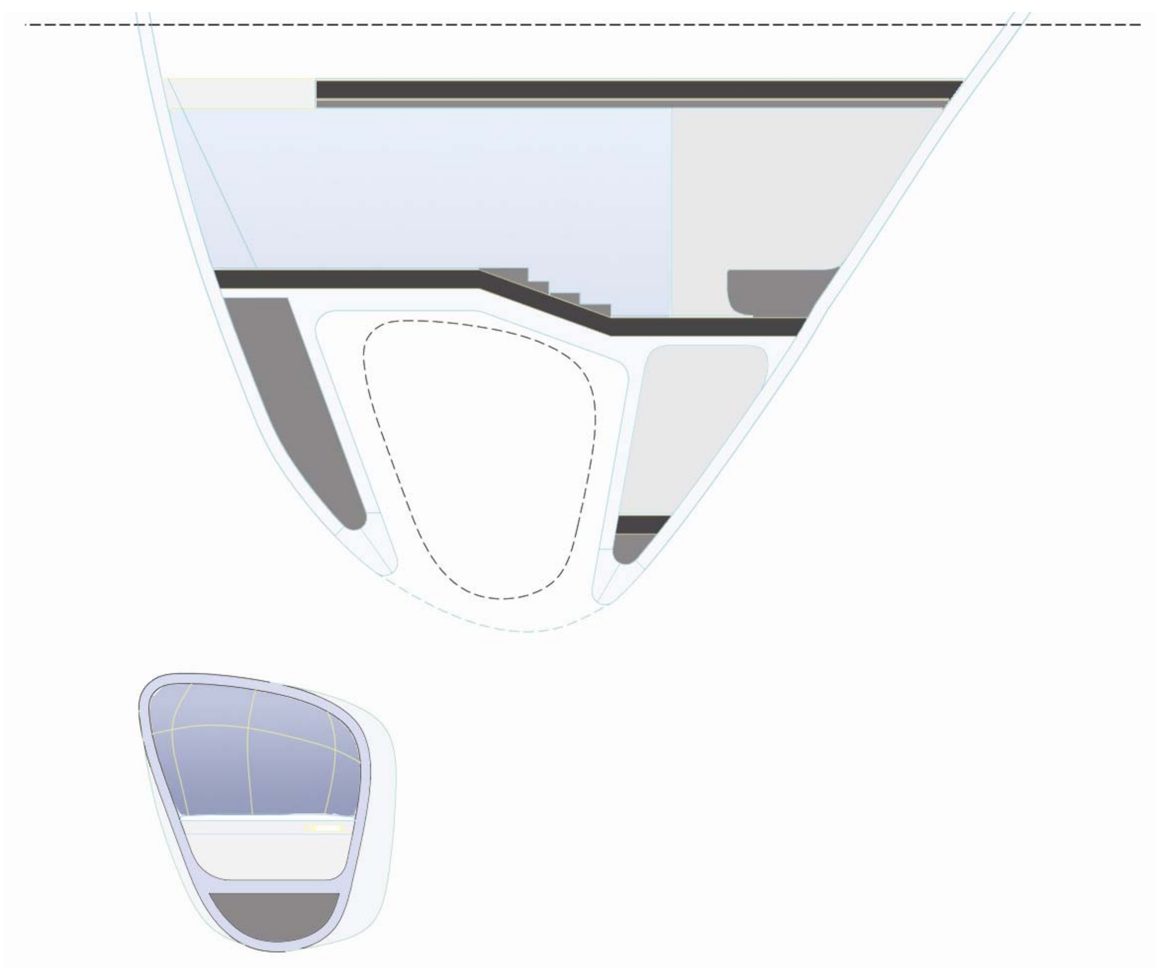
The structural system and its components can be seen on the following pages.

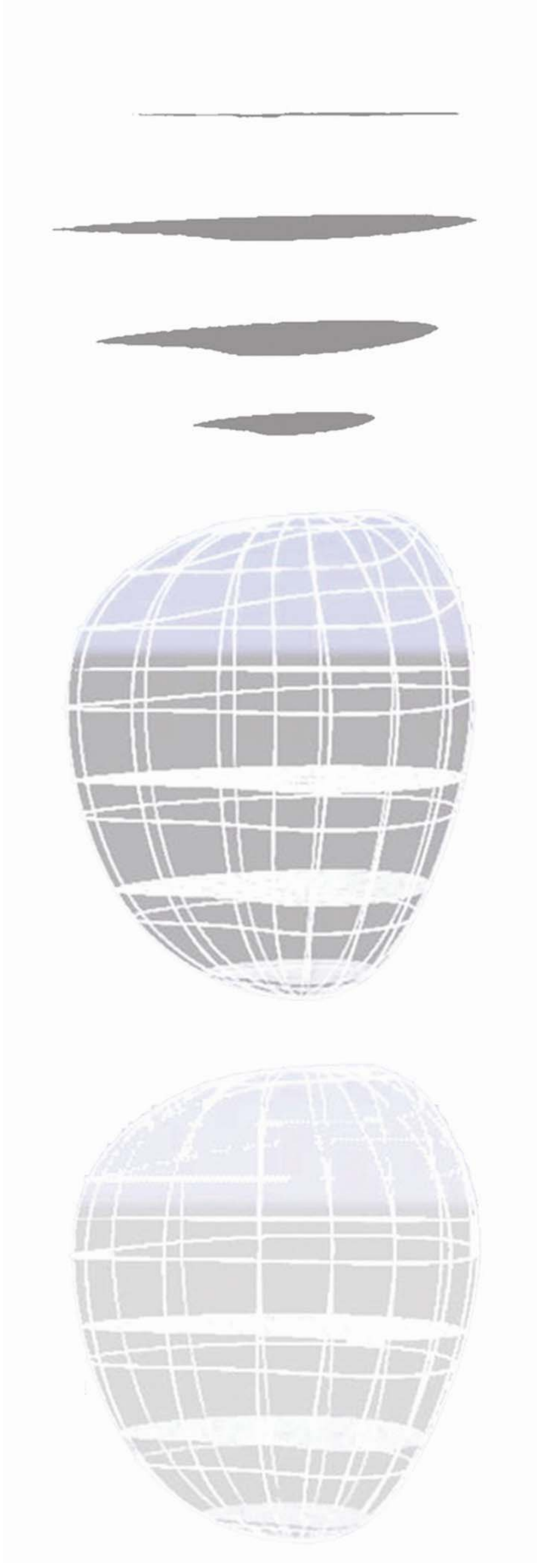


The aesthetic of the section, adopting many more streamlined lines as the previous, has changed to refine itself as it takes on materiality. The irregularity hasn't gone away completely, and still remains on the interior surfaces. This section however, is meant to serve the purpose of describing the different types of vertical circulation within the facility.

Circulation.
This section is cut to show the two open corridors for each ladder, as they are placed on opposite sides of the facility. The ceiling undulates above each entry point of the ladders to direct a visual line down. Just in the previous section, the interior spaces carry over the irregularity from the inspirational images, and the early section's language.

The elevator shaft is much more dominating as well, as its transparent materiality attracts attention. Here the functions are seen as secondary to the circulation, but remain the same. The elevator travels down from the two upper research levels to the common spaces and lower still to the storage and research pod detachment. An addition section details how this actually works.





Structure.

Light Weight Concrete Slabs.

The floor slabs were not originally designed as concrete slabs, but rather my initial design was of a steel framing system. This design was not adapted to the aquatic nature of the project, and failed to register as a building that was meant for the water. A normal building, on land, would use this kind of structure, but in water I looked back to my case studies and uncover a submarine's or boat's structure. They both consist of a shell in which all the structure lives, and the floor slabs are not structural. Once I had developed the exterior shell of titanium and acrylic, the interior floors did not need to be as bulky as I had them. Light weight concrete was the perfect solution.

Titanium Mullions.

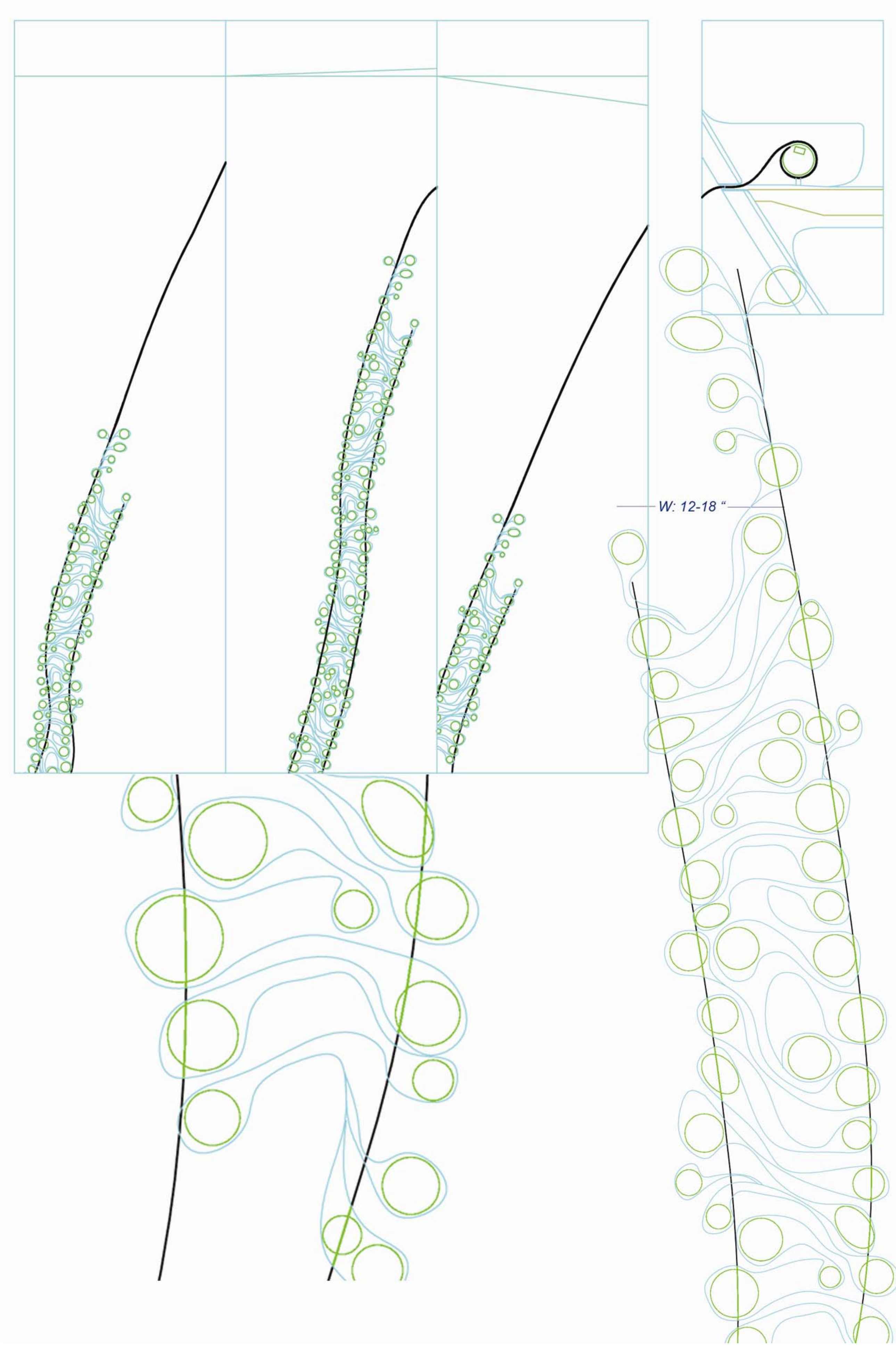
I had been familiar with titanium as an aquatic metal from my research done at the early stage that I compiled the document, Material Palette. This document is located in the Appendix. Titanium had been employed in many underwater applications and had been very successful in the resistance of corrosion. All metals will corrode when exposed to salt water. The tests that titanium was put through to determine its corrosive qualities lasts over a 20 year period, and each showed no corrosion. Even when exposed to higher velocities of underwater currents, it performed extremely well compared to all other metals.

The mullions are an extruded form of titanium to be sized at 6 inches in diameter. They are used in between two welded sheets of acrylic to provide extra structure to the already strong acrylic. There are seven layers of titanium as it travels from top to bottom, and twelve which circle around the structure's circumference.

8" Thick Weldable Acrylic.

Acrylic has been used widely as a transparent material in underwater applications, anywhere from large scale aquarium walls, to deep submersibles. It has properties which can withstand extreme pressure situations at most depths that humans can descend into. Welded acrylic is used at the Monterey Bay Aquarium, making it the largest single piece of acrylic in the world at the present time.

In my design, welded acrylic is used for its performance qualities and its ability to create large pieces seamlessly. In paring with titanium mullions, those qualities become irreplaceable. I wanted to be able to design a system where I could have the observation views I desired, and because it is structurally sound it could be efficient in three different ways.


W: 12-18 “

During the second semester I developed various synchronizations to produce enough power to the entire facility as overlapping time periods in one 24 hour day. Located over a mile from any shore line, and a mile from any power outlets, I would require there to be self-powered options for the inhabitants to pull from. As the ocean is our biggest source of untapped energy, I investigated what kinds of power I could generate and how I could install these within my facility. As the facility is spending all of its time to collect and gather information regarding physical oceanography, why not also use it's subject to power the tools and pieces of equipment it uses every day. I have developed three different ways to do this, and the first is below.

The minimum and maximum amounts of energy the facility will use is between 1982 W and 13880 W.

BioPower.

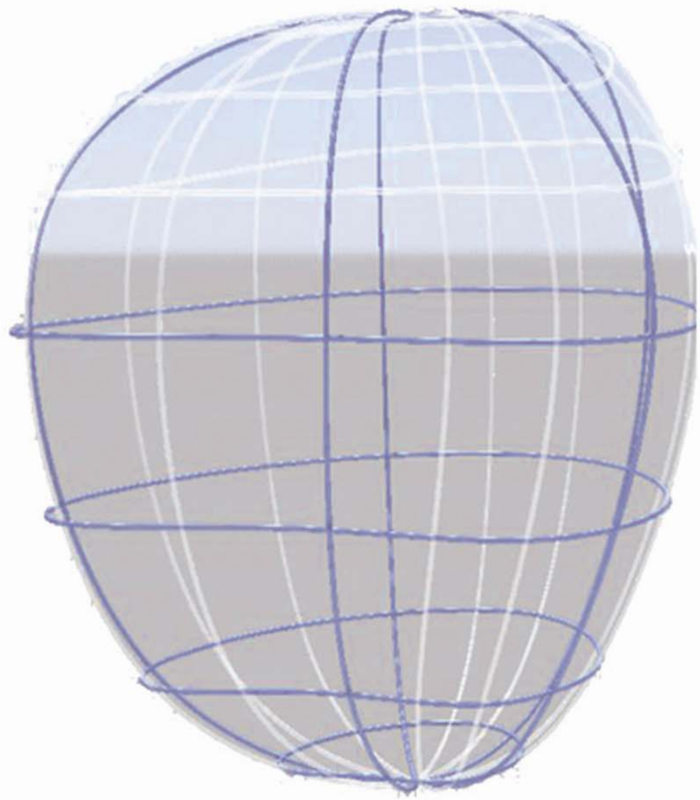
3,846 W – 32,769 W – 61,538 W

P[B]=η.ρ.G.ύ

The type of energy producing operation I call BioPower uses the same natural movements and flow as kelp in the immediate area. By capitalizing on many things including, the tidal and current velocities of the Pacific Ocean, and the Davidson current on my site, I am able to produce energy with the smallest effect on the environment. The underwater velocities are very strong and very consistent, so much that the tension cables will always be exposed to moving water. By attaching a kelp-mimicking system to the entire length of these cables the sensors can be constantly exposed to over 320 vertical feet of water velocity. On each cable, a 12 inch wide water catching system is attached. This system, seen to the left, allows for the water to pass through small sensors which convert this velocity to energy and carry it upwards to the facility.

Just as the BioPower is attached to the cables, it also can perform dually as a piece of the stabilization mechanism. This works by an automated meter that can sense when the facility's floor plates are at too extreme of an angle, and when detecting this can either retract the cable, and BioPower, or let it out.

The wattages above represent the variances of water velocities within the span of depths the cables will come into contact with, and the respective amounts of energy that is possible with each different minimum, mean, and maximum speed.

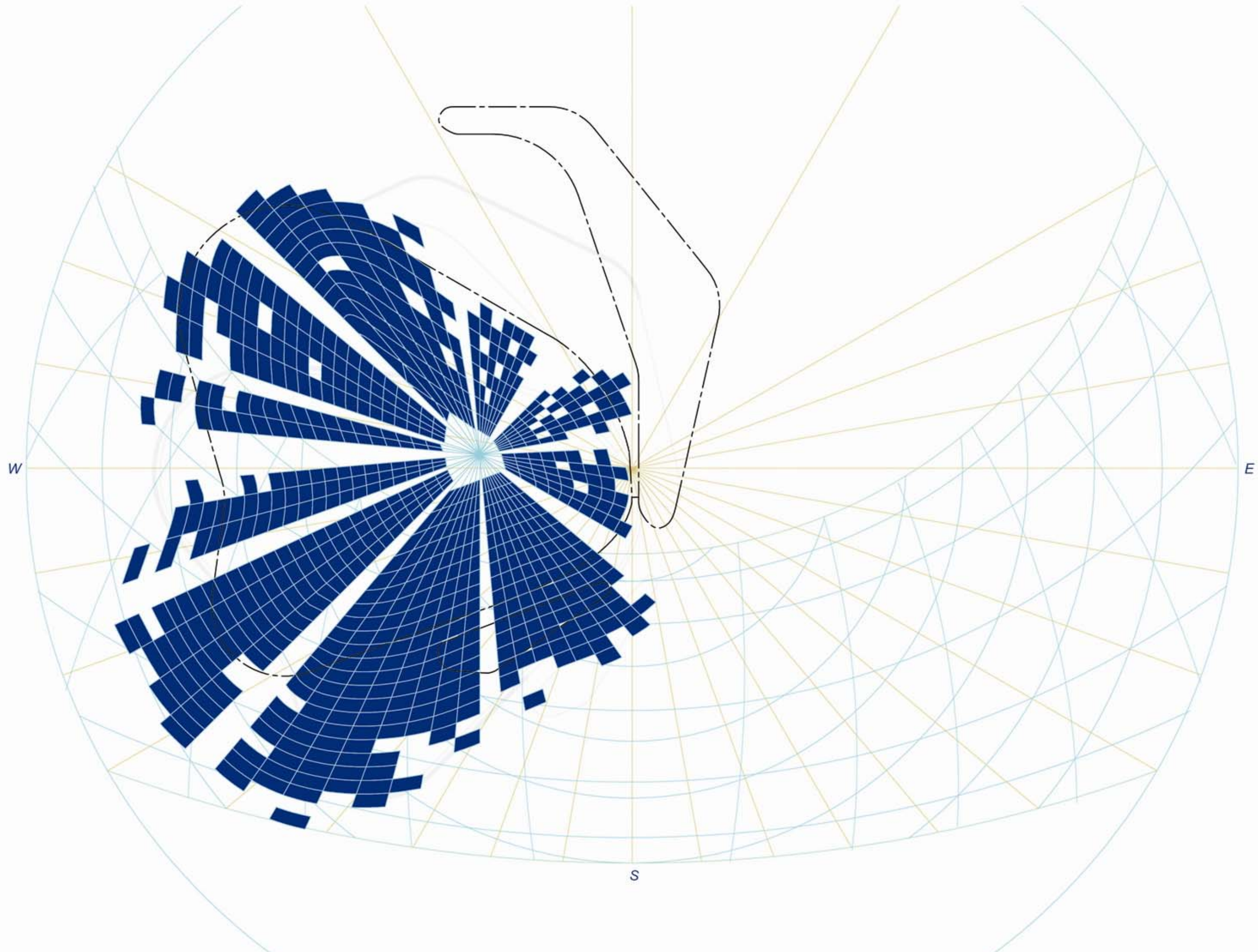


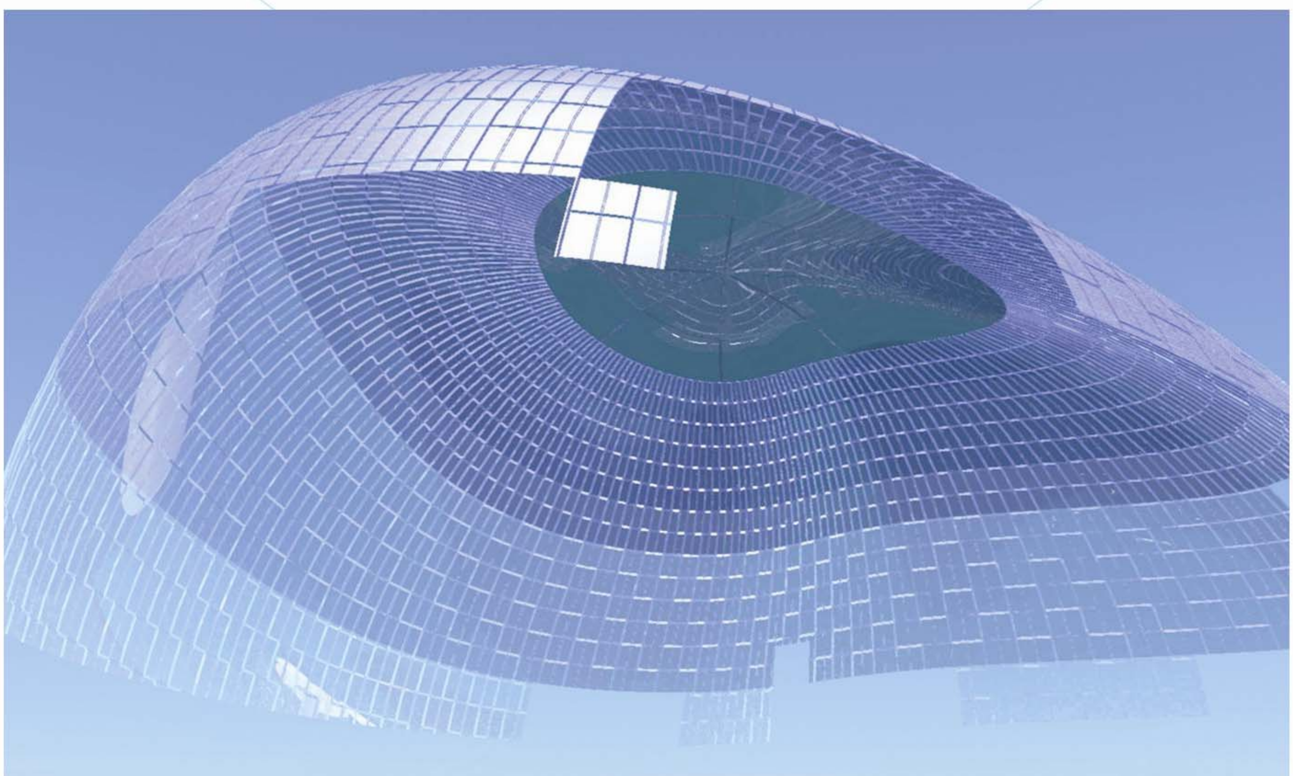
Small Hydro.
322 W – 14, 146 W – 26,568 W
P[SH]=ρ.A.V.Cp

Just as the pervious self-powering option capitalizes on the natural property of water, this is to have the same effect. Fourteen small hydro turbines are located on the facility's underside, and set in a nook produced by the form to gain higher velocities. This technique of energy gain is fairly typical among water power, but the application is typically in a river or stream. I am employing the same technique, but it is a different kind of water speed and direction.

As the water passes through each turbine transfers the motion into energy. Another aspect to this system is a system I call Aqua Thermal. It uses the structural titanium mullions as chambers where the water used to heat and cool the building, to acquire heat or cold from the surrounding waters. It works much like Geo Thermal systems, but is adapted to this aqueous environment, and again, capitalizing on what is currently around.

The wattages above represent the variances of water velocities within the span of depths the cables will come into contact with, and the respective amounts of energy that is possible with each different minimum, mean, and maximum speed.


W
E
S

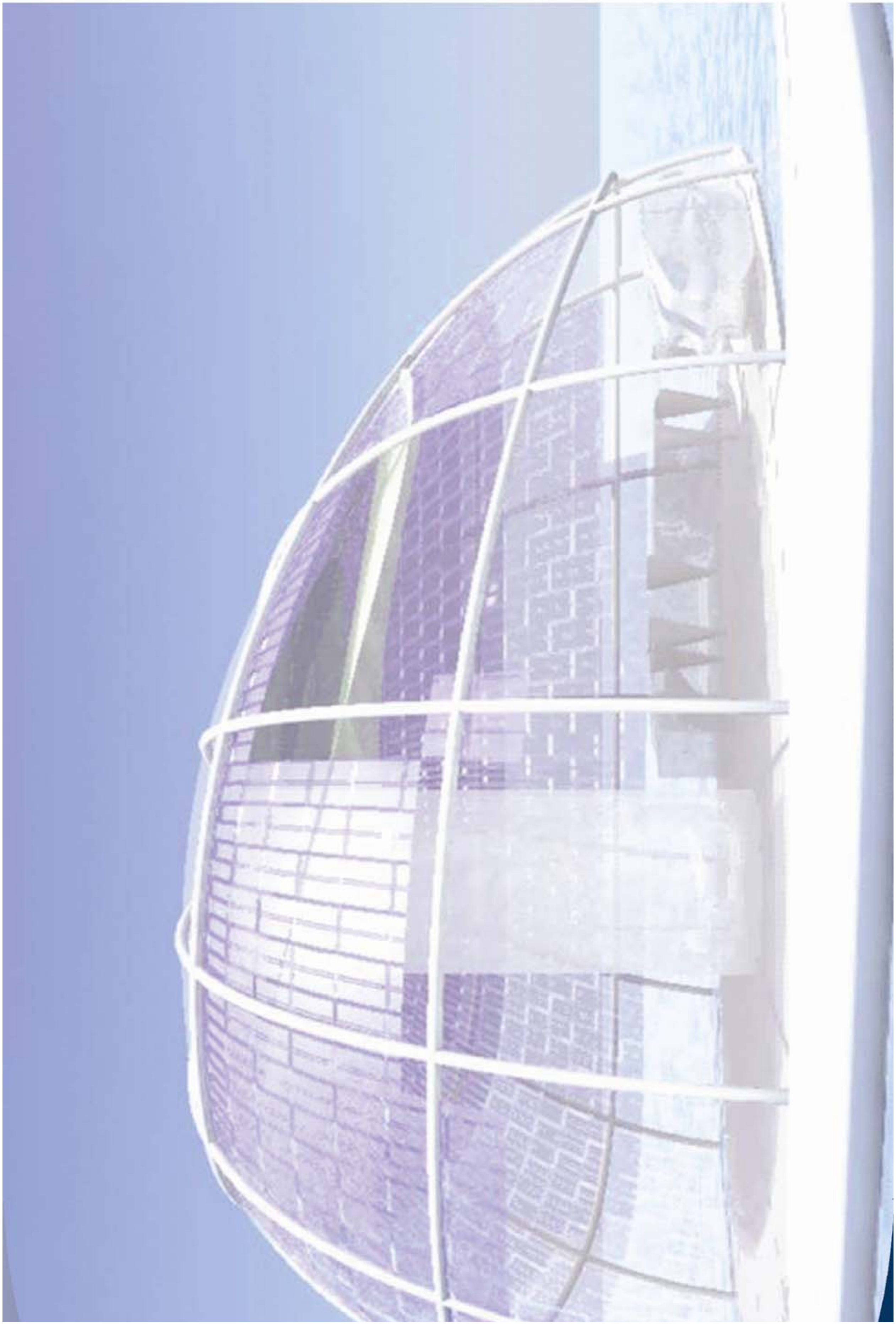


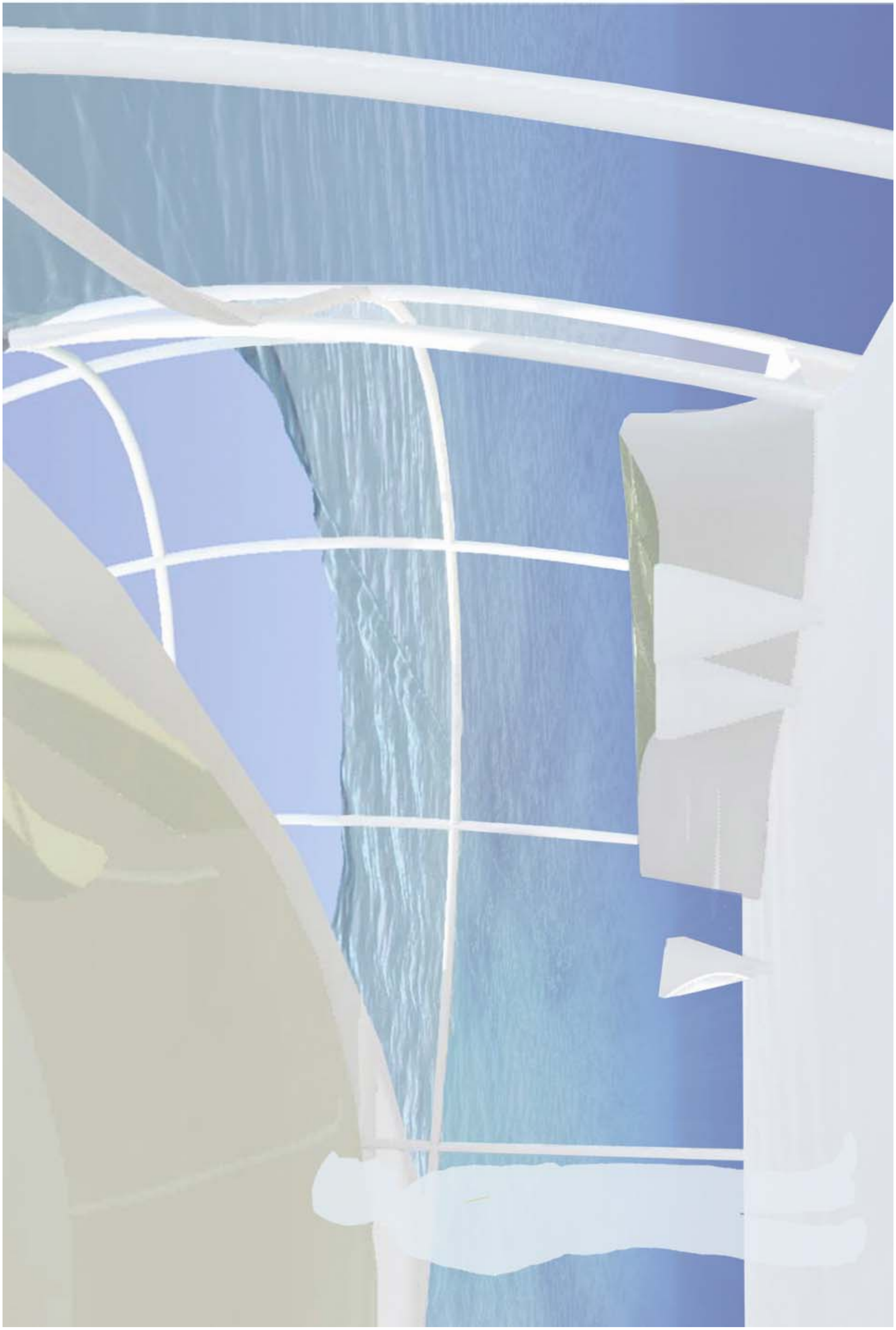
Thin Film Solar.
0 W – 506 W – 743 W
P[S]=Pm/E.Ac

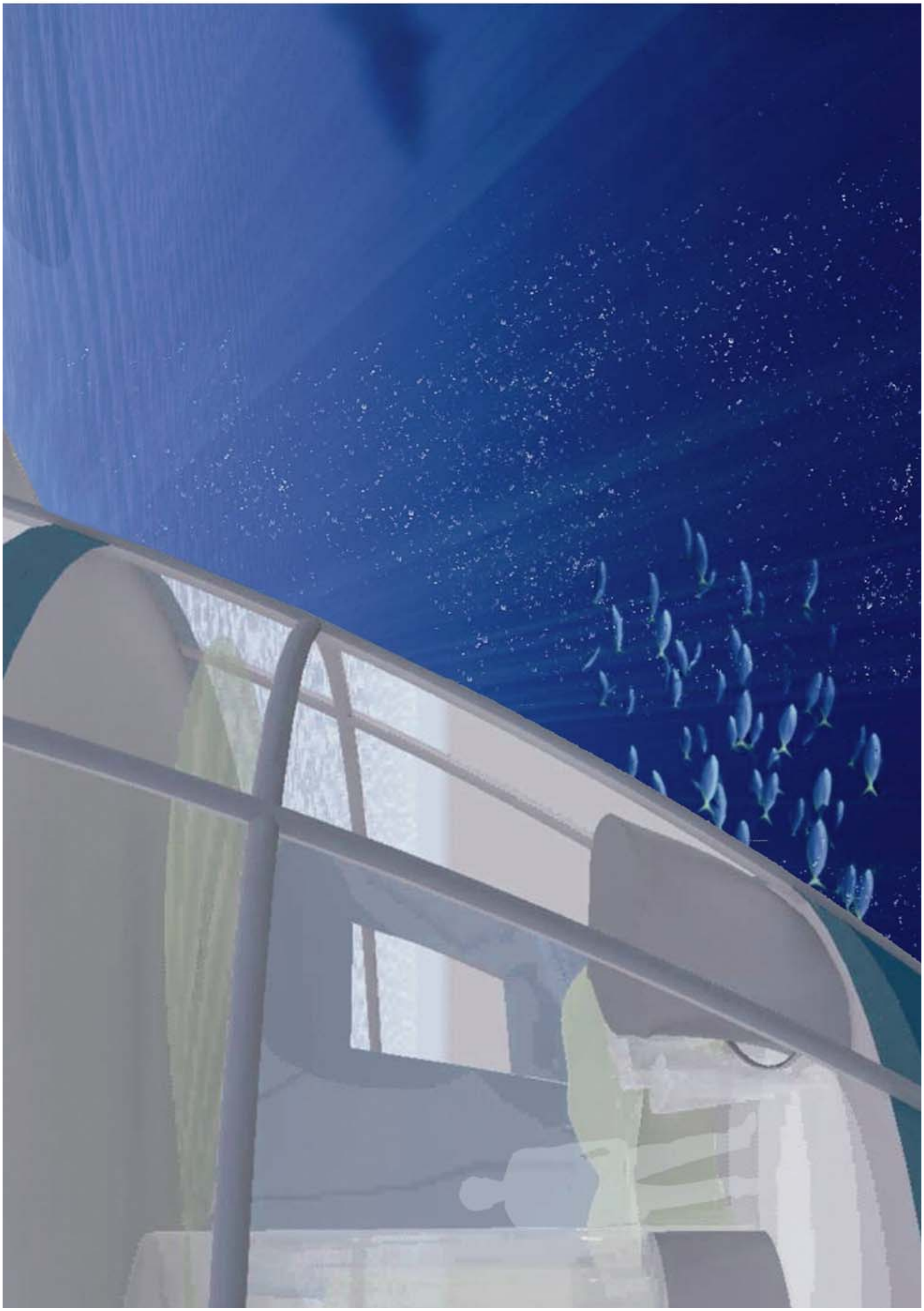
Just as average solar panels perform by accepting the sun's rays to convert them into energy, thin-film will do the same. Normal photovoltaics can act dually as shading devices, while thin-film are vastly transparent.

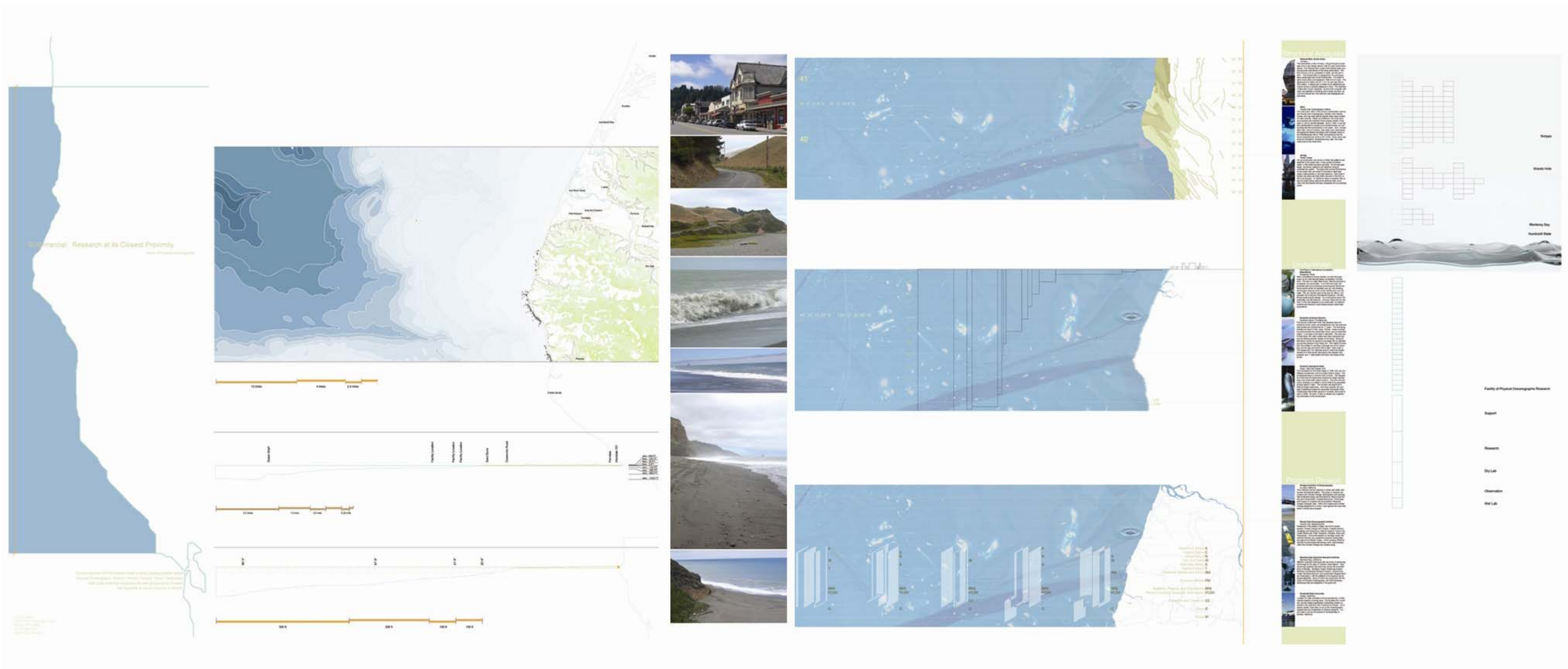
In my case, I have adjusted thin-film panels to act as a shading device as well as producing energy. Thin-films were chosen for the flexibility to be applied to any surface, including curved ones. With the immense amount of sunlight hitting the facility's roof and the amount of acrylic surface it required shading of some kind to help its heat gain. By altering and developing a hypothetical and additional performance quality to a normal thin-film panel I can achieve these two necessities.

The amount of energy gained from this type of power is considerably less than the previous two. This is due to the site only receiving an average of five and a half hours of sunlight every day. The thing to remember is that all of these power outlets can be stored within the facility and used as needed.








Research at its Closest Proximity
Scripps
Woods Hole
Monterey Bay
Humboldt State
Facility of Physical Oceanographic Research
Support
Research
Dry Lab
Observation
Wet Lab

Review Transcription

10 OCTOBER 2007

The Critique:
Jury: Dr. Sharon Kuska,
Martin Despang,
Peter Hind,
Jeff Day

Imagery:

We really need an image or some kind of diagram showing this gap you're talking about. You spoke of it great, and it was understandable, but an image would show it much better as a first big idea. Something is missing, and it's an image that sets the stage for an underwater project. Look into past precedent of cartoons and movies of underwater worlds to see what they do and how they use imagery.

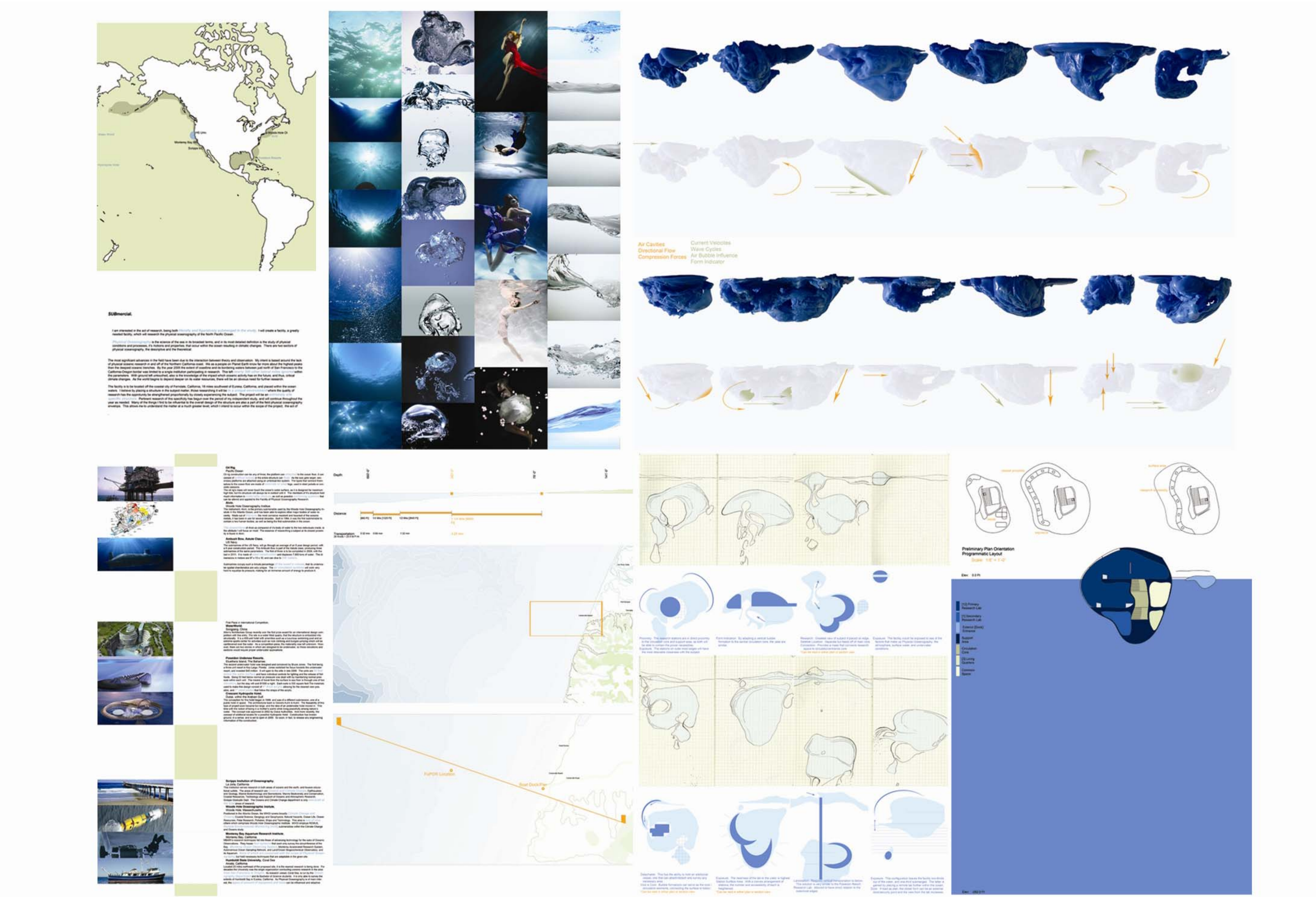
Methodology:

I think you're looking at this too much like an engineer. I don't care about what kind of metals are best in salt water and how much they weigh, and so on and so on. Look at this from an architect's point of view. Get abstract and poetic. This kind of project is a great outlet for your creativity to be used and think about it very organically. Get inspired from whatever you want, but get back to design related conceptual ideas.

Put these aside and for the next critique let's see form related images and ideas. Don't lose what you've done, but just hold onto them for later and for explaining yourself if need be in the end. I'm not discrediting your work, but instead suggesting that you switch focus.

Research Location:

I'm not convinced that by physically being in the subject the research is going to be any better than it could've been elsewhere. I could easily see a research facility in the bluffs behind the site and still produce the same quality of research as in your underwater one. Somehow show me that this is true, or somehow show me that this is just your idea and an idea alone, because I'm not buying it yet.



SUBmercial.
Air Cavities
Directional Flow
Compression Forces
Current Velocities
Wave Cycles
Air Bubble Influence
Form Indicator
Preliminary Plan Orientation
Programmatic Layout
Scale: 1/8" = 1'-0"

28 NOVEMBER 2007

The Critique:

Jury: Dr. Sharon Kuska,
Martin Despang,
Peter Hind,
Jeff Day

Wax Forms:

As I introduced the wax forms many comments arose instantly. The interest was my method of choosing this type of experiment, and what I hoped to gain from it. It was suggested that I take the most intriguing ones and slice them into a section to really see what was occurring inside. I did not look at them as if they were pieces of architecture, as if every void was fenestration or every bulge was a room. Rather I saw them as form indicators and language that I could decode to interpret into architecture. I was interested in the process of formation they each took. From the moment they slipped out of the hot glass container and into the vase of ice cold water, I analyzed their formation. The connection between them and the architectural solution I proposed at this stage was untraceable. The connection between the plans and sections to the abstract images was apparent, however. The wax forms needed more attention and more time spent to fully get the information that I was looking for. Time became an issue for me, but I did manage to create a number of new forms where I cut sections to analyze. These can be seen in following review transcriptions.

Imagery:

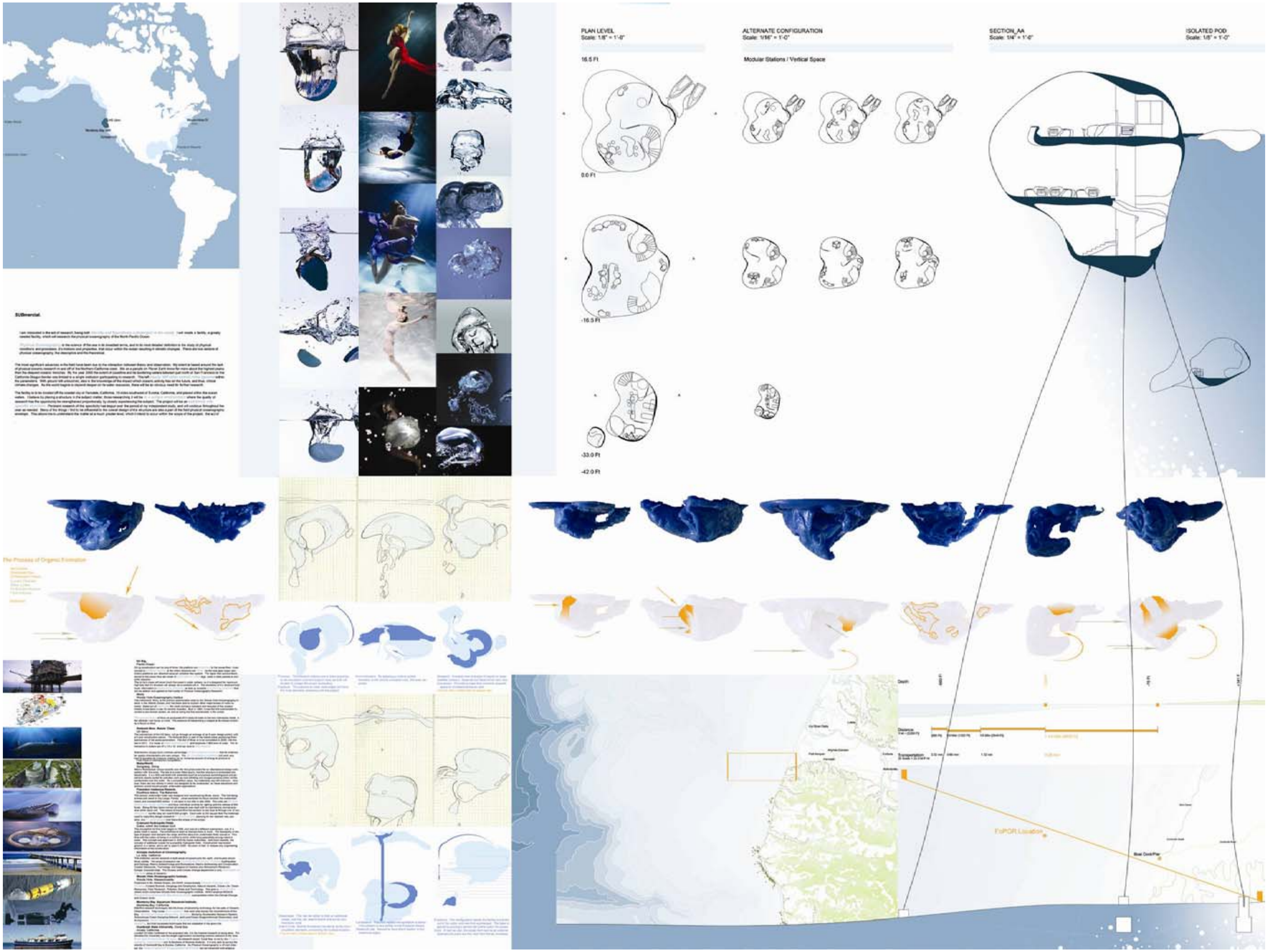
The imagery I used was well received. My initial image of the lack of physical oceanography research was very explanative.

The abstract images were well liked as conceptual inspirations, but there was not enough text to help explain why I was intrigued with them as individuals.

The large section, as presented to show the exact proportions and scale of it in the water with the bottom of the page acting as the bottom of the ocean, was a strong point. It helped the jury place the facility in the water and on the site.

Plan:

The plan did not read as an aquatic structure with the dominant stair case placed directly in the middle of each floor. It truly was not developed enough at this point to gain better criticism. The programmatic distributions, however, was easy to understand and made sense logically. This remained constant, where the research was located on the upper levels, and the common space on the lowest.



SUBmercial.
PLAN LEVEL
Scale: 1/8" = 1'-0"
16.5 Ft
0.0 Ft
-16.5 Ft
-33.0 Ft
-42.0 Ft
ALTERNATE CONFIGURATION
Scale: 1/16" = 1'-0"
Modular Stations / Vertical Space
SECTION_AA
Scale: 1/4" = 1'-0"
ISOLATED POD
Scale: 1/8" = 1'-0"
The Process of Organic Formation
Depth
Distance
Transportation
FoPOR Location
Boat Dock/Pier

17 DECEMBER 2007

The Critique:

Jury: Dr. Sharon Kuska,
Jeff Day,
Chris Ford,
Hyun Tae Jung,
Tim Hemsath,
Camilla Rice,
Tom Laging,
Patricia Morgado,
Bill Borner,
Ted Ertl,
Mark Hoistad

The majority of the concern was the lack of explanation in how I arrived at my proposed architectural solution. There was an overall, but mindful, lack of text in my blind presentation that I intended to try to emit some creativity from my audience.

Location:

The roughness of the ocean was of the first concern of many of the jury members. Worrying that it would be too rough to conduct research and not provide enough stability, they suggested that it be of a rigid structure to resist this.

Form Indicators:

The inspirational images I chose to display failed to fully explain where I took guidance from to indicate my section and plans. There were three different stages within my form process, which included two self-made types. The sketches that simply imitated bubbles and added architectural notation were not read clearly by the jury. To better have an understanding of my results, there needed to be one additional step within these. The other being, wax forms I created to recreate the process of naturally-forming forms. The large amount of them and the large size of them, even though previously acclaimed by my consistent jury, was not understood. Again, here if there would have been more text that explained them perhaps they could have been understood better. The bottom line here was the line of process was difficult to follow.

Form:

The large amount of organic aesthetic to my final proposal lead the jury to assume that the walls might not be sturdy but rather move with every wave and motion from the water that it may have been too organic and too irregular. It was in my schedule to apply materials during the start of my second semester, but perhaps it needed refinement for the shapes to be understood and seem logical. The members seemed to require enough reasons to why this facility might be able to exist, but I didn't present them. For this presentation I chose to focus more on conceptual design rather than schematic design. This may or may not have been a mistake on my part, because I feel that because I was asked to represent my work I was awarded with criticism that I wouldn't have otherwise gotten.

Plan Configurations:

I presented three versions of each floor plan displaying three different configurations of the flexible furniture. These were confusing to the extent that our discussion never addressed my floor plan layout and organization. My solution was to omit the optional plans from my presentation.

Second Semester:

There was some doubt that I wouldn't have enough work to complete my material selections, structural, technical, and mechanical systems during the second semester. This is how I did spend my time. I also readdressed the form, since it was such a big topic of discussion during the critique. Refinement was already in the works, but I chose to look at the form once again before I did this.

The Idea:

My original idea for my Terminal Thesis Project was misunderstood. After explaining that I was interested in the act of research within the topic of study, and what physical oceanography is, the connection among some of the jury could not be made. Instead of words, I made an answer for this to be presented in April that showed my idea visually.

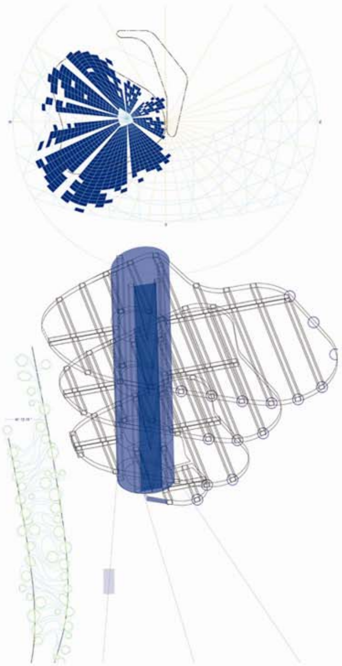
This same concept followed me throughout my critique. It seemed as though my presentation boards were not read. For the small amount of text I chose to present, the words I did use were very meaningful and very understandable if one were to read them while also taking in the visuals. I struggled a lot with this for obvious reasons.

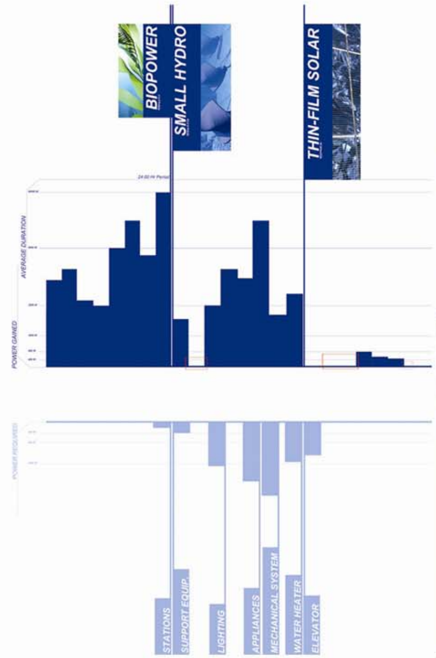
BUILDING MATERIALS
from the Exterior to Interior

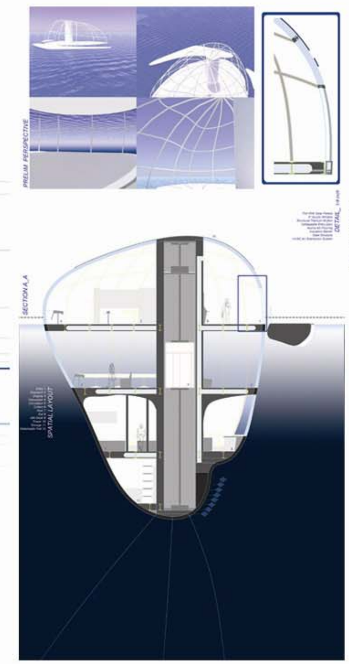
PHOTOVOLTAIC:	Thin Film panels	[912 lbs]
ACRYLIC:	Double-Pane with Light -Emitting Capability	[29190 lbs.]
TITANIUM:	2" x 2" Titanium Bracing acting as acrylic Mullion	[540650 lbs]
A1020 STEEL:	Flex-C Trac metal structure and framing	[84648 lbs]
INSULATION:	Exterior Wall Insulation	[4670 lbs]
INTERIOR WALL:	Flex-C Trac stud framing	[14655 lbs]
ATC:	Transparent Ceiling Tile on curved Track, includes Light Fixtures	[6758 lbs]
ALUMA-TEK:	Aluminum Flooring of #5052 Alum. Alloy sheets	[124740 lbs]
		[806223 lbs]
BREATHABLE AIR:	Recirculated Air including Air Exchanger Equip.	[7217 lbs]
PERSONS:	Maximum Occupancy of 18 persons	[3249 lbs]
		[10466 lbs]

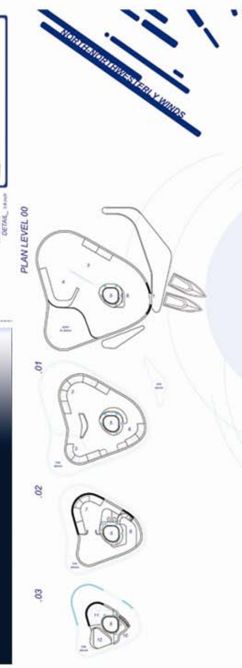
EQUIPMENT

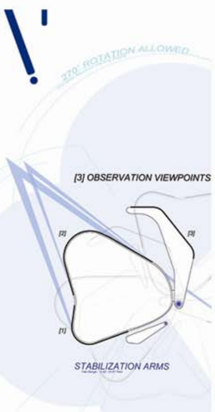
STATIONS:	12 Research Stations including computers, chairs, and tables	[1335 lbs]
DATA RECIEVER:	Wireless Server to trasmit incoming data	[124 lbs]
PLOTTER:	Wireless Printer and Plotter	[134 lbs]
MECHANICAL:	Mechanical System to recirculate breathable air	[1170 lbs]
ENERGY:	Sustainable Energy Reciever and Distributer	[1728 lbs]
ELEVATOR:	Elevator Chamber to also envelop Structure	[3500 lbs]
DOOR:	Exterior Doors are to Withstand the Elements, and allow for Pressurization	[620 lbs]
APPLIANCES:	Kitchen and Living Appliances include Waterless Toilets, Range, and Microwave	[771 lbs]
LIVING:	Four Twin Beds and Seating	[480 lbs]
		[9862 lbs]











SPATIAL LAYOUT

Total Research Study Area:	1800 s.f.
8 Research Stations	800 s.f.
Dry Lab	450 s.f.
Wet Lab	200 s.f.
Research Deck	350 s.f.

Equipment:
- Digital Equipment Corporation (DEC) Alpha 3000
- SSB Satellite Electronics
- VHF Radio Electronics
- Long Range, Short Range RADAR
- Furuno Color Fathometer
- GPS Electronics and Plotters
- Salt Water Temperature Sensor
- SIMRAD Hydrographic Surveyor

Total Common Area: Support Space	700 s.f.
Total Mechanical Area: Hydro Powered Generator, BioPower Reciever, Mechanical Room, Restrooms	650 s.f.
Total Area of Structure:	**3250 s.f.**

28 FEBRUARY 2008

The Critique:

Jury: Dr. Sharon Kuska,
Martin Despang,
Peter Hind,
Jeff Day

Form:

Pull back from refining the form too much. The uniqueness of your first semester solution was so organic and poetic, that we're missing out on that right now. Meet in the middle of the images we're seeing right now and maybe that is solved in the interior spaces. Look into marrying the third levels characteristics to the remaining levels. What if the floors became the walls, and the walls became the desks?

Go back and relook at the wax forms you produced to start adapting those to your solution you're showing us now, and try to analyze them together and connect them more. Then you can get back to what amazed us so much last semester.

Power Options:

The BioPower solution is very much in tune with your original way of thinking. Try to get back to that, and not hold yourself back when thinking about the form now and tomorrow. I get the feeling that after the semester, you felt like you had to make it architecture, and typical architecture at that. And don't. Rethink about the overall shape and what it is that you really want to produce. Go back to the inspirational images and the wax forms. This BioPower is the closest thing we see that carries over from last semester.

Buoyancy Calculations:

We don't need to know that much about the weight of each and every material you are using. All we want to know is it if works or not, and if your calculations are correct.

Structure:

The proposed structure looks and feels too much like a building on land. Why can't the structure be found in the shell, as if it were a submarine or boat? There is weldable acrylic that can support immense amounts of weight while also making a completely clear seam. The titanium can very well be thickened and used as a rib-like structural system.

03 APRIL 2008

Presentation Review before My Panel. 03 April 2007. 5:30pm. Gallery, Location #1.

When I was preparing to create a terminal project, one that I would propose in writing to this College before starting it, my thoughts kept centering around one main idea. The idea is designing a research facility where the inhabitants are literally and physically submerged in the study.

So, I first thought of instances where this could occur…

Finally coming to the conclusion, and after researching these broad topics of study, I found there is a considerable gap in the Northwestern corner of United States in Physical Oceanography Research. Two things came together in a sense here, my interest in a type of architecture that has not been fully realized, insert underwater architecture, and a field that is forecasted to increase in importance over the next decade, insert physical oceanography. *Both of these things made me feel like it would be a great outlet for my intent:*
to create an underwater research facility where the inhabitants are submerged in the study of Phys. Ocean.

This gap exists from the Monterey Bay Aquarium Research Institute, just north of San Francisco to the CA-ORE border where the Oceanography Department of Oregon State University has adequate funds, the space in between is severely untouched and in need of an additional research facility of physical oceanography. One inadequately funded Institution lies here however, Humboldt State University, and for its size cannot reach the spectrum between MBARI and OSU. In this gap that is nearly 300 miles long with two research organizations on either end, I chose to travel along the coast of Northern California to select a site, as well as speak with the Dean of the Oceanography Dept at HSU.

Before I go into details, I'll explain what Physical Oceanography is.
It is the study of physical conditions and processes. It's made up of motions and properties that occur within the ocean resulting in climatic changes. *Therefore, we can think of it as the currents within the oceans, the tide patterns affecting the shore line, and the wave cycles.* It is not concerned with individual marine life, unless, in reference to my site, the upwelling of phytoplankton blooms that affect water current patterns and temperature.
In the end, Physical Oceanography is any physical condition occurring in the ocean that affects the atmosphere.

The facility is to be located 1¼ miles from the shore of the coastal city of Ferndale. *To select the site, I began preparing documents over the summer to aid in my decision. I compiled geographical conditions and those of detailed water conditions of Northern California.* As I did this, I focused on the ease of accessibility to the site where boats are to be located to transport individuals to the facility. Ferndale is two miles from Highway 01, and Interstate 101 that leads north 18 miles towards Eureka and Humboldt State University.

The tools associated with Phys. Ocean are primarily observation systems and remote stations. *The proposed facility is to achieve these two items by allowing maximum observation points, remote sensoring, and acting as a remote station itself.* The functions of the facility are to be run in intervals. The program consists of the following

12 Research Stations with the necessary tools of physical oceanography research (Digital Equipment Corporation (DEC) Alpha 3000. SSB Satellite Electronics. VHF Radio Electronics. Long Range, Short Range RADAR. Furuno Color Pathometer. GPS Electronics and Plotters. Salt Water Temperature Sensor. SIMRAD Hydrographic Surveyor.)
A Dry/Wet Lab
Research Deck
Support Space that connects and serves all previous spaces
Living Quarters to include beds and kitchenette
Mechanical Space
Making up a total of 4,300 square feet with the majority of that dedicated to the research area and support spaces.

After traveling to Humboldt State University to speak with the Dean of the Oceanography Department, I selected other facilities or institutions to research as case studies in the programmatic requirements. The remaining are MBARI, HSU, Woods Hole Oceanography Institute in Woods Hole, Massachusetts, and Scripps Institute of Oceanography in San Diego. These gave me a wide variety of generic Physical Oceanography departments within a greater specialty of Oceanic and Marine Research. Other case studies showed me the ratios between humans and volume within the ocean, as well as materiality selections. *These examples came from looking at submarines, oil rigs, and small submersibles.*
Others allowed me to see if underwater architecture *had been successful in current projects like the Hydropolis Hotel and the Poseidon Resorts. These two examples being of current projects under construction that both hold information of vertical circulation and materiality*

I then began Conceptual Design

I first looked towards the organic manner of the ocean, in its naturally occurring events.
Represented by three strips of these images include:
An abstract of placing my facility in water and the droplets that are formed,
The physicalities of humans in water and their behavior presented as female figures,
And the moments of time that are seen when bubbles rise to the surface of water.

I took inspirations from these images and the processes that make them to create architectural language. By analyzing them, I was able to visualize possibilities of program and organization within.
The varying relationships that resulted were the following:
Outward facing elements to enhance the observation piece of Physical Oceanography.
Detachable submersible for further exploration.
Hollow vertical shaft to enclose mechanical, structural, and technical systems.
The placement can either be completely submerged or left exposed on the top floor.
The location of the research lab within the facility.

As I received multiple options from these types of analysis, I began to also look at how these images were formed and attempted to do the same with an additional material, wax. The experiments from the wax helped me to see and understand how they are naturally formed underwater. So, *when combining the information from the wax forms, the added architectural notation to abstracted forms, and the observational qualities of Physical Oceanography, I came up with several preliminary spatial layouts*.

As I refined the form, I also focused on THREE other qualities I wanted my project to have.

Application of Materials. As I chose materials to apply to the structure, the form began to refine itself for this purpose. The overall form had to adapt to these materials, so the variations from first semester had to straighten out. This change is due to my goals from first semester and second semester.
Titanium Mullions, 8” Acrylic, and Lightweight Concrete Floor Plates.

Structural Components. When designing in an aquatic environment, buoyancy calculations came into play very early on, and dictated what and how the structure was designed. No longer was the structure based off of the central core, but now moved to the circumference of the form. Designed as a shell first, and secondly as an inhabitable place for research.

Self-Powered Opportunities. Located within the ocean, there were many chances for myself to acquire the necessary power outlets for powering this facility. The first being Solar Power, where there are an average of 6 hours of sunlight every day. The second, small hydro power, capitalizes on the underwater tidal currents close to the surface. And the third, biopower, which uses the tension cables as a location to hold onto and transmit energy through a wind-catcher-like mechanism that imitates kelp.

Through all of these final three aspects I integrated into the design, the original idea has remained true.
Observation Viewpoints
Placement of the 12 Research Stations
Central Vertical Circulation
Detachable Research Pod


SPACE STATION
JUNGLE TREE HOUSE
OCEAN SUBMERSIBLE
VOLCANIC HUT
EARTHQUAKE MONITOR
SUBMERCIAL
KRISTIN UBBEN
Senior Terminal Project
Mentor: S. Kuska
07Fall_08Spring
FoPOR Facility of Physical Oceanography
The IDEA is Research occurring within the subject matter
Designing a research facilty where the inhabitants are literally and physically subemerged in the study is an intriguing aspect of research related to the outcome the research can hold, as well as the experience of submersion.
The STUDY is Physical Oceanography in the northern third of California's Pacific Ocean
Here, there is an emmense gap of Phsical Oceanography Research. It is the study of physical conditions and processes, the motions and properties that occur within the ocean that result in climatic changes. The topic has a vast impact on our planet's future and a great applications for sustainability.
The ARCHITECTURE is Aqua-tecture
The form of its structure is to act as an appendage of the ocean, its subject. An extremely site specific structure, it must address stability, bouyancy, and self-powered applications. The research activity, primarily observational, will dominate the structure's program and floor layout.
CASE STUDY
Materiality Applications
Mass Proportions
Support Structure
Program Requirements
Form Dictation
Existing Underwater Precedent
1. HOW WOULD AN UNDERWATER OBJECT FORM ITSELF?
A flexible medium is dictated by the forthcoming surroundings it will eventually live in. The object does not want to be foreign, but rather act as an appendage.
2. WHAT ENVIRONMENTAL FORCES WILL DICTATE IT?
Just as the study of Physical Oceanography deals with the physical properties of water, those same motions, tide cycles, velocity patterns, and wind speeds will dictate the shape it takes.
3. IF I COULD RECREATE THE EXACT PROCESS WHAT WOULD RESULT?
When recreating this process of formation, I must act as environmental forces and study the resulting formations that occur. Air bubbles, general shape, and the tendencies to see similar forms after each pass are each vital in understanding how an object forms.
4. ONCE THE HYPOTHECITAL FORM IS SHAPED, HOW DO I TRANSLATE IT INTO ARCHITECTURE?
I can translate them by finding patterns of how the form is altered once entered into water. I can translate both the exterior and interior spaces from these wax forms.
FORM PROCESS
FORM DICTATOR
INSPIRATION
PHYSICALLY SUBMERGED IN STUDY
LITERALLY
FoPOR
RESEARCH AT
ITS CLOSEST PROXIMITY
MATERIALS
PERFORMANCE
LACK OF RESEARCH
SITE
Section
Plan
Supportion
Efficiencies
WIND SPEED DIRECTION
STABILIZATION
MAXIMUM OBSERVATION
PROGRAM
MATERIALITY
OPERABLE SHADING VENTILATION
RESEARCH P.O.D.
STABILIZATION
VERTICAL CIRCULATION
AQUA-THERMAL
CLEAN WATER WASTE DISPOSAL
BIOPOWER
3,846 W
32,769 W
61,538 W
SMALL HYDRO
322 W
14, 146 W
26,568 W
THIN-FILM SOLAR
0 W
506 W
743 W
FIBER WT. CONCRETE SLAB
TITANIUM TUBE STRUCTURE
8" STRUCTURAL ACRYLIC
AQUA-THERMAL

03 APRIL 2008

The Critique:

Jury: Dr. Sharon Kuska,
Martin Despang,
Peter Hind,
Jeff Day,
Chris Ford,
Dean Wayne Drummond,
Keith and Meriellie from Michigan University

Imagery:

To get a better and more accurate sense of the true weather conditions, it would have been more explanative to produce three or four different conditions of water intensity. Idea needs to be more vivid.

Approach to Project:

I find it so intriguing that a student in the Midwest is designing for the Ocean. There's probably a student at Berkeley designing in a corn field. It's so interesting the idea of digging into the ground, and in your case the water, to find architecture, because it's against all our existing examples. All of a sudden there are no elevations of the building, but in your case there are because water is transparent. It's a solid-void relationship. A thesis project should be a project that an engineer would *never* think of. You want to blow them out of the water with what you can come up with. Separate yourself from the formalities of architecture, and explore what it could be. The presentation for December was far more compelling than this. Follow your instinct more than your intellect. We were so fascinated with what you were doing and the size of them now is insignificant to their importance. Think about dematerializing this, like an air bubble is. Just as one of your inspirational images does, it's not about the material at all but more about the space that is formed inside.

Wax Exploration:

The wax forms are extremely compelling because I want to know what you got from them. It's such a different process that I haven't seen here yet at the University. One that you did something without truly knowing where it would lead you or what you would learn about it. I almost wish you wouldn't been able to study them further and maybe even prolonged the move to architecture at the semester break. To analyze them further, maybe you could've added many different types of analysis where some of them are locating sizes and shapes of rooms and walls. Perhaps if you were able to produce more wax forms and not reach the level of architectural plans and sections you could've gained even more from them. Maybe that's something as a College we need to think about. Are plans and sections *really* needed in December? I think this would be the perfect example that they aren't.

Form:

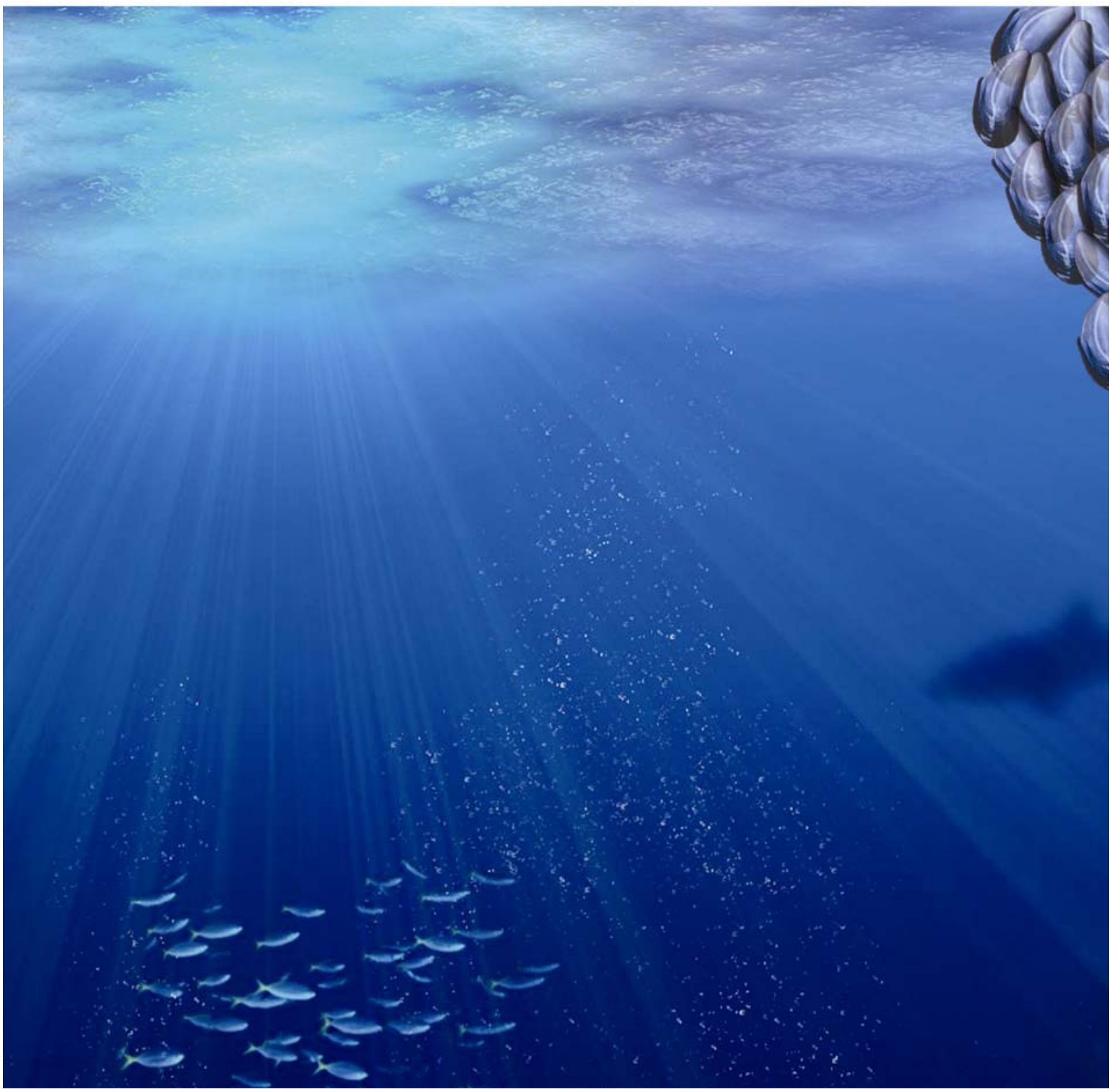
The form of the object must be more compelling. It's just too simple looking and it looks like something I've seen before, it's nothing new and innovative. Especially for underwater architecture, I think there are many more solutions you could've reached for. I really wish there were an instance where you were face to face with the surface of the water. You've cut the above and below line right at a floor plate. What if that were at eye level for the researchers? And the openings in the fenestration are far too open. There is a point where if the windows are too big and there's nothing to look at they're get to be too much of the same thing. What if there were very selective openings so that those experiences of the ocean were celebrated? And then further, what if the only images we saw were those from the inside out? Then it's part of the presentation and part of the design at the same time. Very similar to that of an outer space vehicle where there are limited openings because of two things, one there is so much to look at that it's all the same and, two, the views that you do see are so celebrated and so fascinating that it's worth the wait. This is where social ties come into play. The unknown is always being desired.

Water Information:

It is the times when a vessel is in motion that there is silence in the living quarters, and when the ship is anchored the sound is constant swishing sound. The motion of any object in the ocean is in a Figure 8, and any object that is meant to be in the ocean is designed for constant movement against the current.

Research at its Closest Proximity

Space Station researching within Outer Space
Jungle Tree House researching within the Amazon Rainforest
Ocean Submersible researching within Oceanic Activity
Iceberg Shelter researching within Global Warming
Volcanic Hub researching within Tectonic Plate Motion
Earthquake Monitor researching within Fault Zones



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