Jarić, Marko S. “Figure 1. Piled Oil Platform and Gravity Oil Platform.” In *Classification of offshore oil and gas plants*. October 2024. DOI:10.69644/ivk-2024-02-0222. https://www.researchgate.net/publication/385614332_Classification_of_offshore_oil_and_gas_plants.

EVOLVING WITH NATURE

Repurposing Oil Platforms through Ecological Succession

2024 Young Architects Competition: Iron Island
Site: Italian Offshore Oil & Gas Platforms
Building Area: 6,059 m2
Individual Work

Offshore oil platforms occupy an ambiguous position between obsolete infrastructure and emerging habitat. Although built for extraction, their submerged structures often become artificial reefs, supporting marine ecologies that may be disrupted by total removal. The project begins with this contradiction: how can an industrial ruin be decommissioned without erasing the life that has formed around it?

The proposal retains the existing steel framework and inserts a minimal-surface system that is structurally stable yet materially porous. Its continuous geometry reduces material use, encourages natural ventilation, and provides a framework for gradual ecological occupation. Rather than preserving the platform in a single permanent state, the new architecture is designed to weather, dissolve, and be colonized over time.

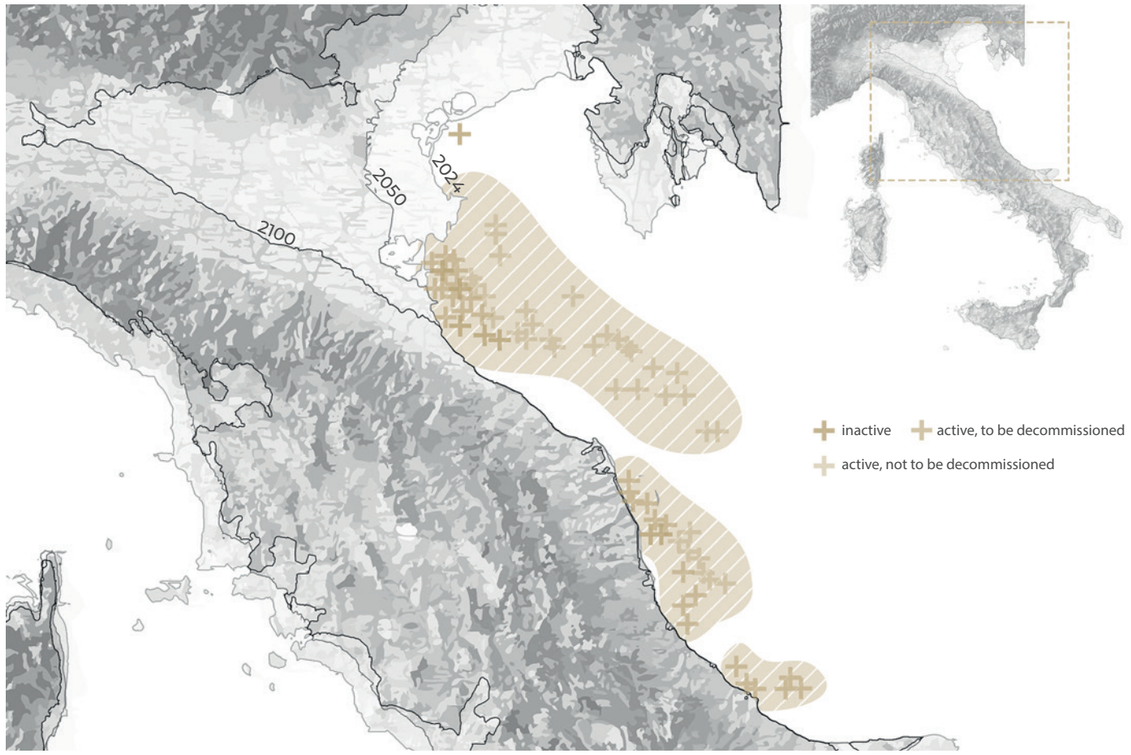
Three material systems guide this transformation. Coral gradually occupies and reinforces the minimal surfaces. Seawater-soluble floors register human presence but disappear as rising water reaches them, converting formerly occupied spaces into marine habitat. Algae-integrated glazing provides shading and privacy while filtering air and producing biomass energy. Passive ventilation, wind power, and bioenergy allow the platform to operate with limited external resources.

The program changes with the structure. It begins as a research institute and museum, transitions into a healing center as inhabitable space retreats upward, and eventually becomes a sanctuary for marine and avian life. Human occupation is therefore not treated as the project’s final condition, but as one stage within a longer ecological succession. The former instrument of extraction becomes an architecture capable of accommodating its own disappearance.

offshore oil platform

marine ecology

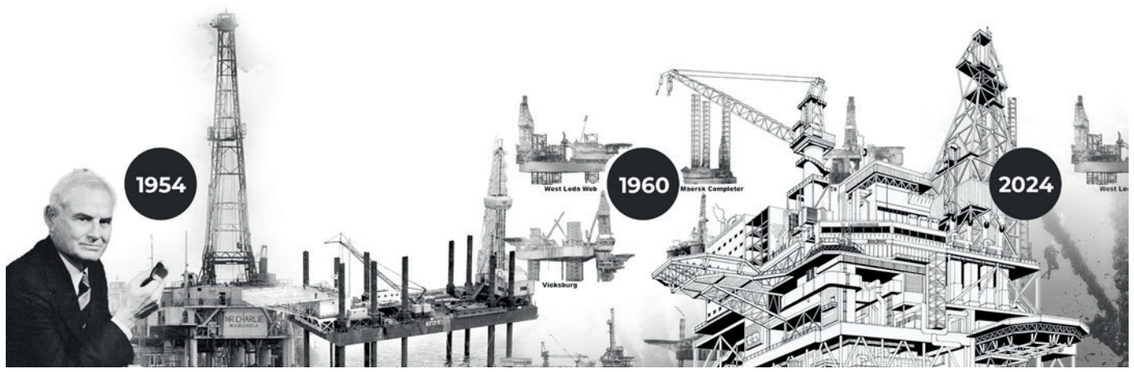
eco-friendly solution?



OIL PLATFORMS AT THE CROSSROAD OF ABANDONMENT AND RISING SEAS

There are 132 offshore mining platforms (12 inactive) around Italy. The "Pitesai Master Plan" restricts new resource extraction within 12 miles of the coast. As a result, 72 platforms (55% of the total) must be decommissioned once resources are exhausted. On the other hand, sea levels continue to rise due to climate changes. Between 1993 and 2019, a rate of 2.76 mm/year was observed after accounting for subsidence.

DEVELOPMENT OF OIL PLATFORMS AND MODERN PREDICAMENTS



1954

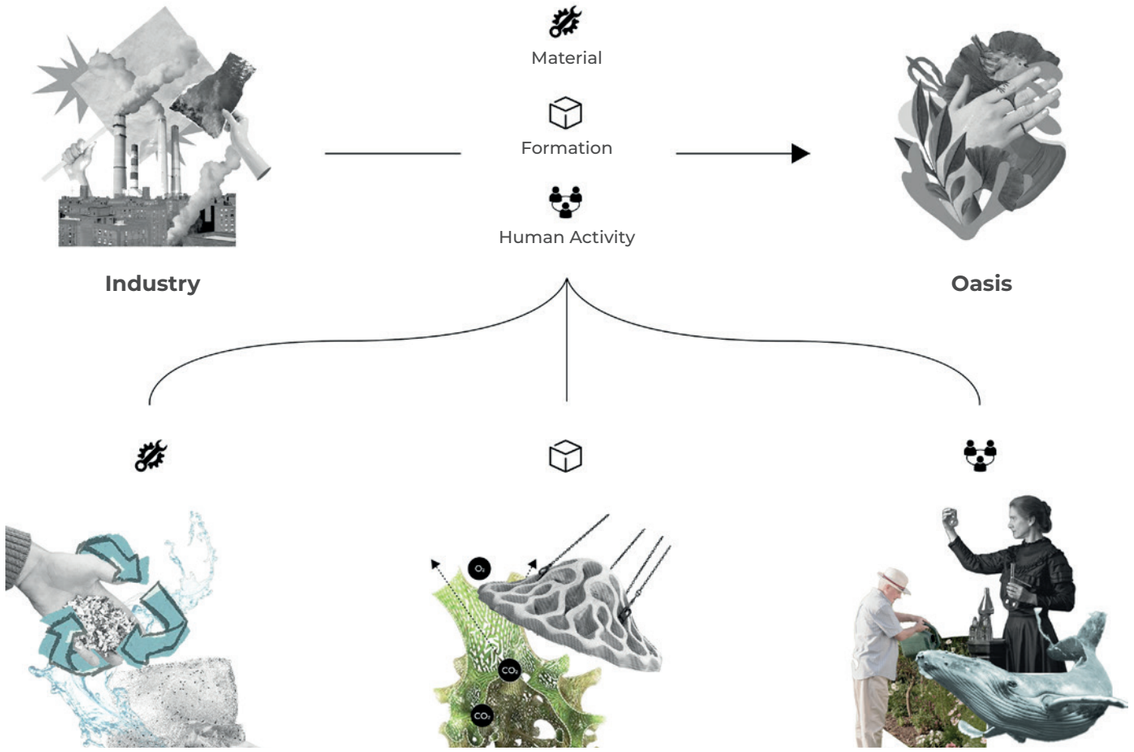
Mr. Charlie, the first purpose-built open-water MODU rated for 40-ft water depth. The Gus I also built this year was the forerunner of the modern jackup.

1960

In the 1960s modern offshore facilities emerged, with topside structures above water and jackets as underwater meshes supporting the topside and resting on the seabed.

2024

Today, abandoned platforms are facing uncertain futures. Underwater, they have become artificial reefs, providing refuge for marine species. Repurposing them to align with decarbonization and sustainability goals is urgent.



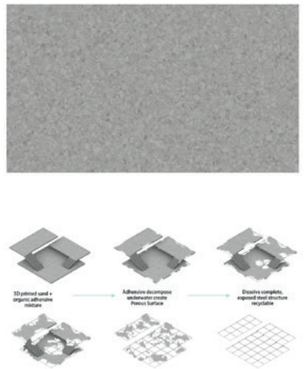
FROM INDUSTRY TO OASIS: MATERIAL, FORM, AND HUMAN ACTIVITY

The design begins the shift from an industrial structure to a marine ecological oasis by using sustainable materials and energy-efficient forms. These allow oil platforms to be reused in a greener way. Over time, people in the new building will focus on protecting marine ecology and creating the oasis, helping the ecosystem heal and grow. In the end, human activity will stop in the building, giving the space back to nature.

THE FUSION OF ORGANIC MATERIALS AND DESIGN

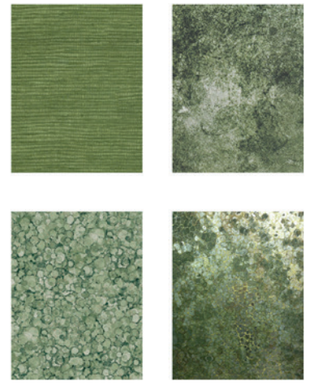
Coral

Coral is divided into soft and hard types. Hard coral is commonly used in coastal construction, transformed into limestone, or as a cement substitute in building materials.



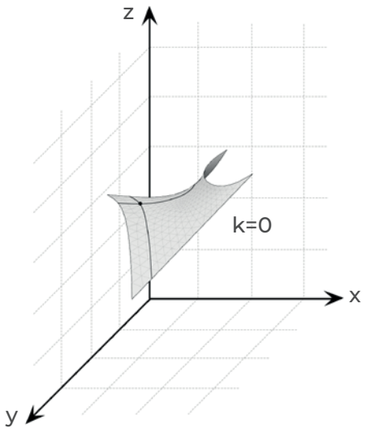
Sand + Organic Adhesive

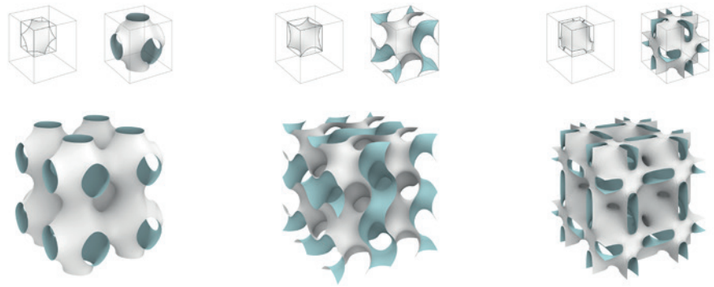
This experimental material combines sand with an organic adhesive that dissolves in water, forming porous habitats for marine life, promoting biodiversity and ecological resilience in ocean environments.



Algae

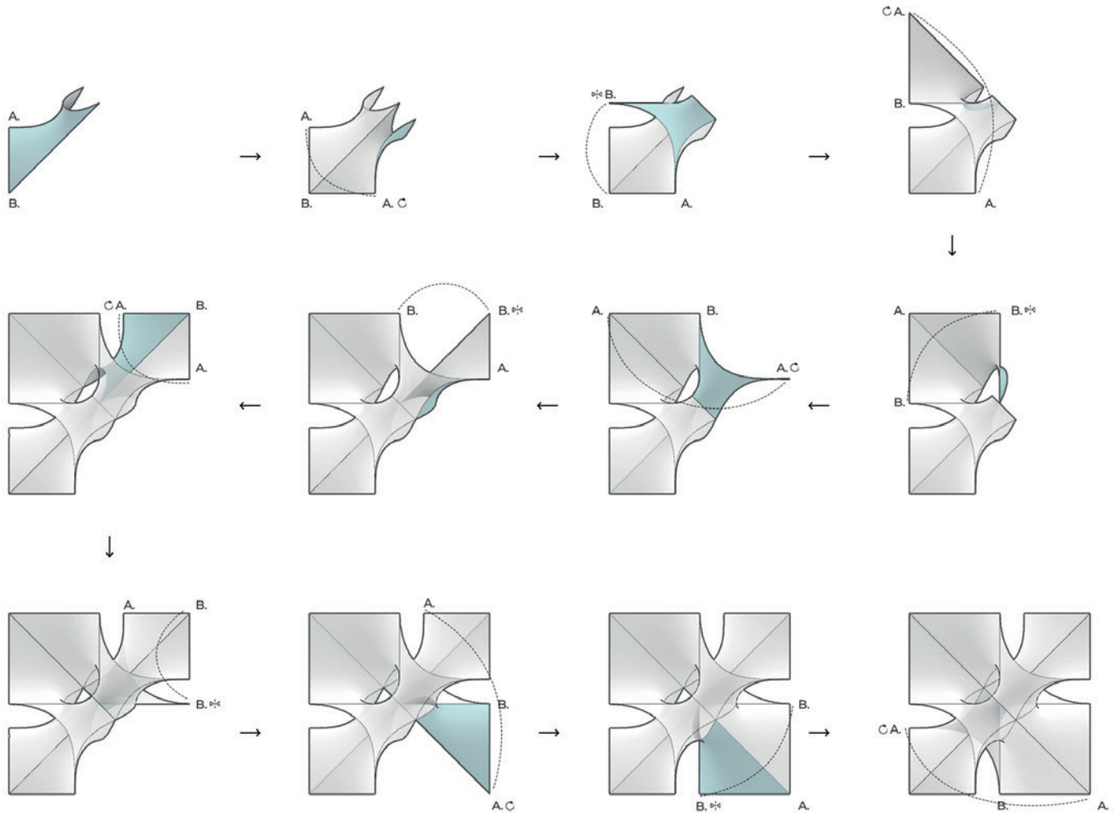
Algae is integrated into bio-reactive facades to enhance energy efficiency, purify air, and adjust transparency, offering natural light filtration while leveraging algae's environmental benefits for sustainable building design.





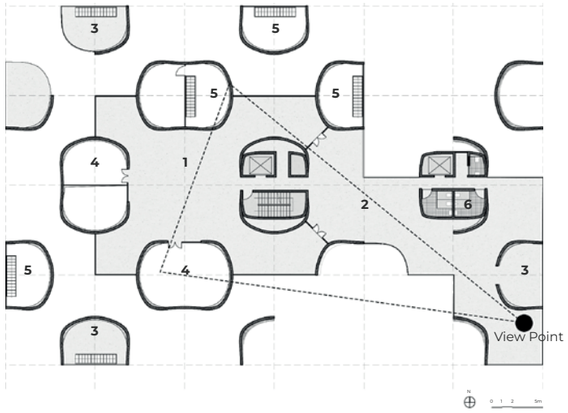
MINIMAL SURFACE

A minimal surface locally minimizes its area, meaning any small patch requires the least materia. It also has separable properties, where any sub-patch still maintains minimal area with the same boundary. Mathematically, a surface is minimal if its mean curvature is zero everywhere, indicating balanced curvature without bending inward or outward.



BATWING SURFACE GEOMETRY ANALYSIS

The Batwing surface's fundamental regions (shown in blue in the steps) fit within a tetrahedron, representing 1/48 of a full lattice cell cube. The final step shows the Batwing totally filling a cube, displaying 12 fundamental regions. Although it appears to be a lattice fundamental cell, it is not; opposite edges almost match under translation, but small gaps of about 0.02 exist. The isometric view on the right depicts the complete cubical unit cell, illustrating the full complexity and symmetry of the Batwing surface.

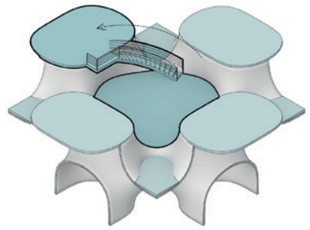


1. Indoor Exhibition Hall
2. Outdoor Exhibition Hall
3. Public Resting Balcony
4. Small Exhibition Room
5. Laboratory
6. Toilets

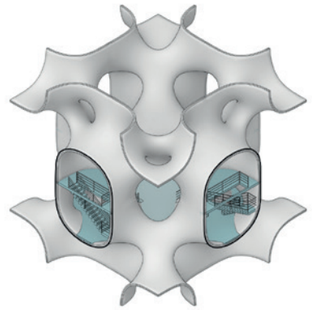
NATURAL FORMATION OF LOFTY SPACES

Periodic Repetition of Minimal Surfaces

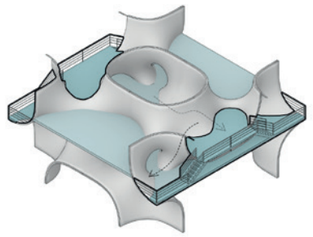
In Batwing Minimal Surface, the periodic repetition creates holes of varying sizes. Larger holes naturally form proportional raised spaces. These spaces allow small holes to introduce natural light, which shifts dynamically with the curved surfaces. The interplay of light and shadow creates a soft, varied architectural experience, evoking the fluid, transformative qualities of the underwater world.



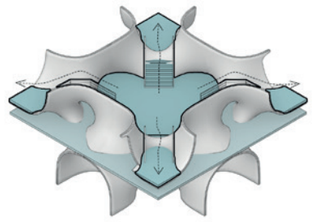
Four basic modules combine to form a spacious lower area. A staircase hugging the curved surface leads to an oval-shaped public platform.



Eight basic modules stacked together form four enclosed oval-shaped rooms. These rooms serve as fundamental spaces for small laboratories and residence.

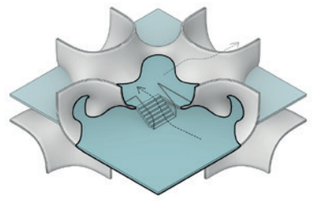


This is a set of spaces at the design's boundary. A staircase connects a group of paltfroms with the height difference of 1.3m, serving as viewing platforms.

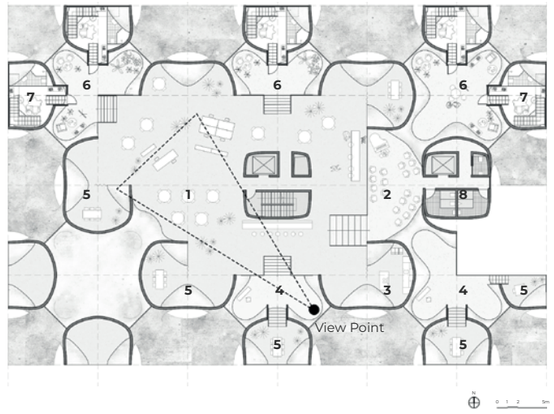


The steps connect the central large area and the smaller edge platforms. While the height difference provides a sense of separantion of spaces.

The small labs and residences are accessed via steps from a semi-private platform 1.3 meters higher. The platfrom serves as a shared space for the surrounding rooms.



By removing one basic module, a larger space is created. This space provides access via steps to a semi-private platform, which in turn leads to the oval-section rooms.

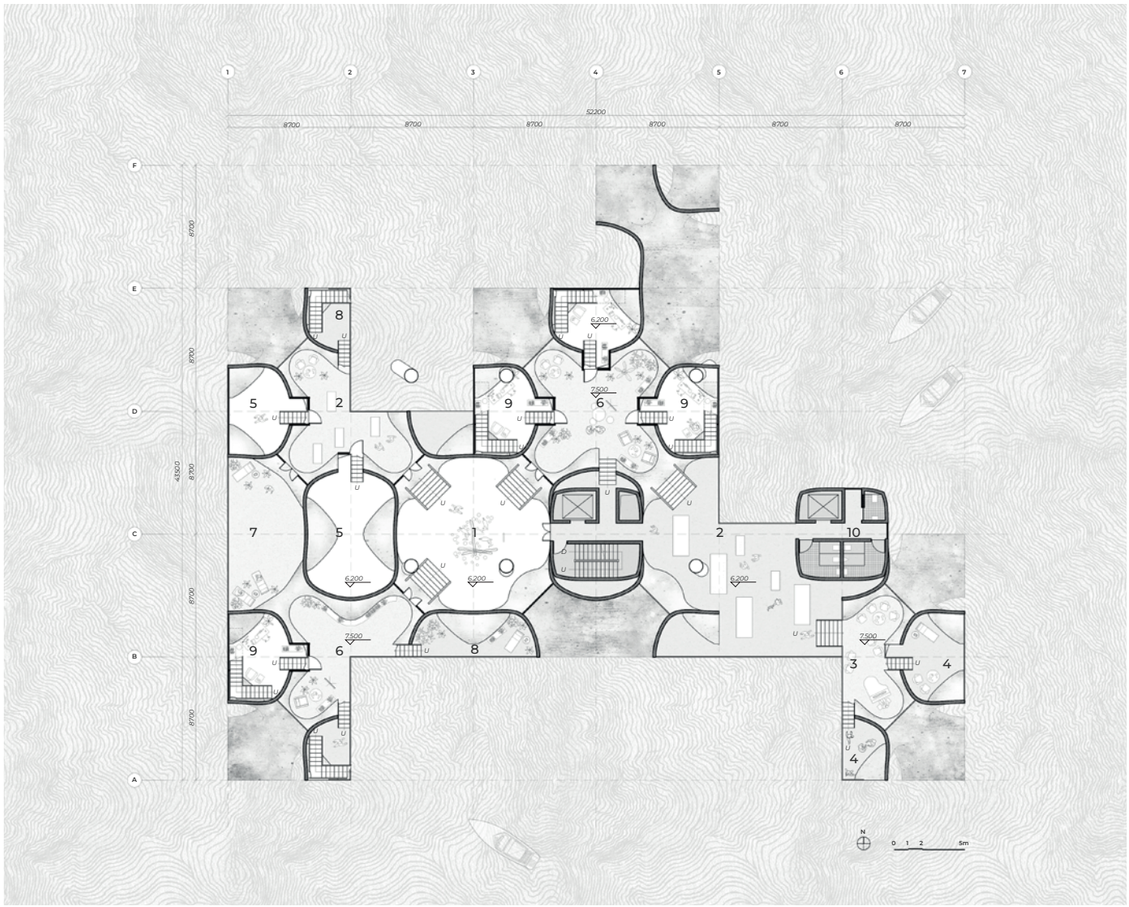


1. Sky Café & Restaurant
2. Performance Platform
3. Kitchen
4. Serving Platfrom
5. Private Balcony
6. Semi-public Space
7. Residence Loft
8. Toilets

ACTIVE FORMATION OF HORIZONTALLY OPEN SPACES

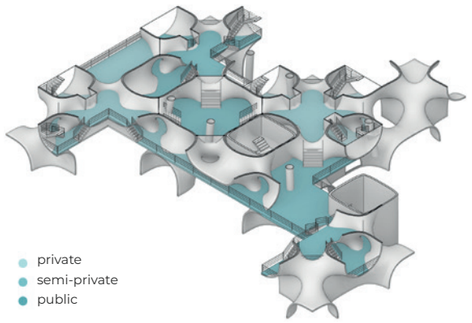
Formation Through Removal

By removing minimal surface units in the periodic repetition, a larger, more open flat space is created. Horizontally, the continuous floor slabs enhance a sense of extension, contrasting with the enveloping holes of the periodic design. Vertically, removing curved surfaces opens the space, allowing sunlight to naturally filter in, creating a more open and inviting environment. It balances spatial openness with light, enhancing both the aesthetic and functional qualities of the space.



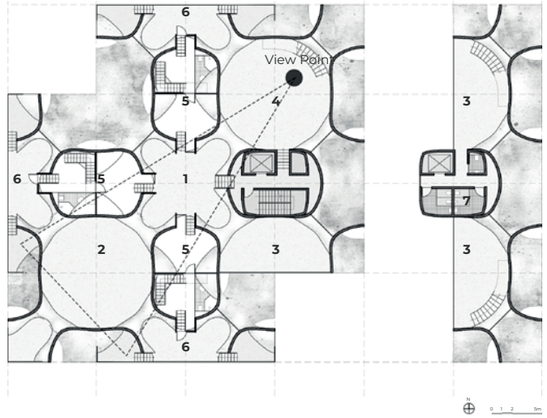
NAVIGATING PRIVACY: FROM PUBLIC TO PRIVATE

Secondfloor Plan



1. Indoor Exhibition Hall
2. Outdoor Exhibition Hall
3. Performance Platform
4. Public Resting Balcony
5. Small Exhitbition Room
6. Semi-public Space
7. Semi-puclic Resting Platform
8. Private Resting Balcony
9. Private Indoor Labs
10. Toilets

The space near the vertical transportation core is expansive, serving as a public museum with both indoor and outdoor areas. Adjacent to it are semi-private entrances for 1-3 two-storied labs, seamlessly connecting public and specialized spaces. A semi-private resting platform is also on this level. This design strategy effectively facilitates a smooth transition from the open, public spaces to the more secluded, private laboratories, enhancing both functionality and user experience.

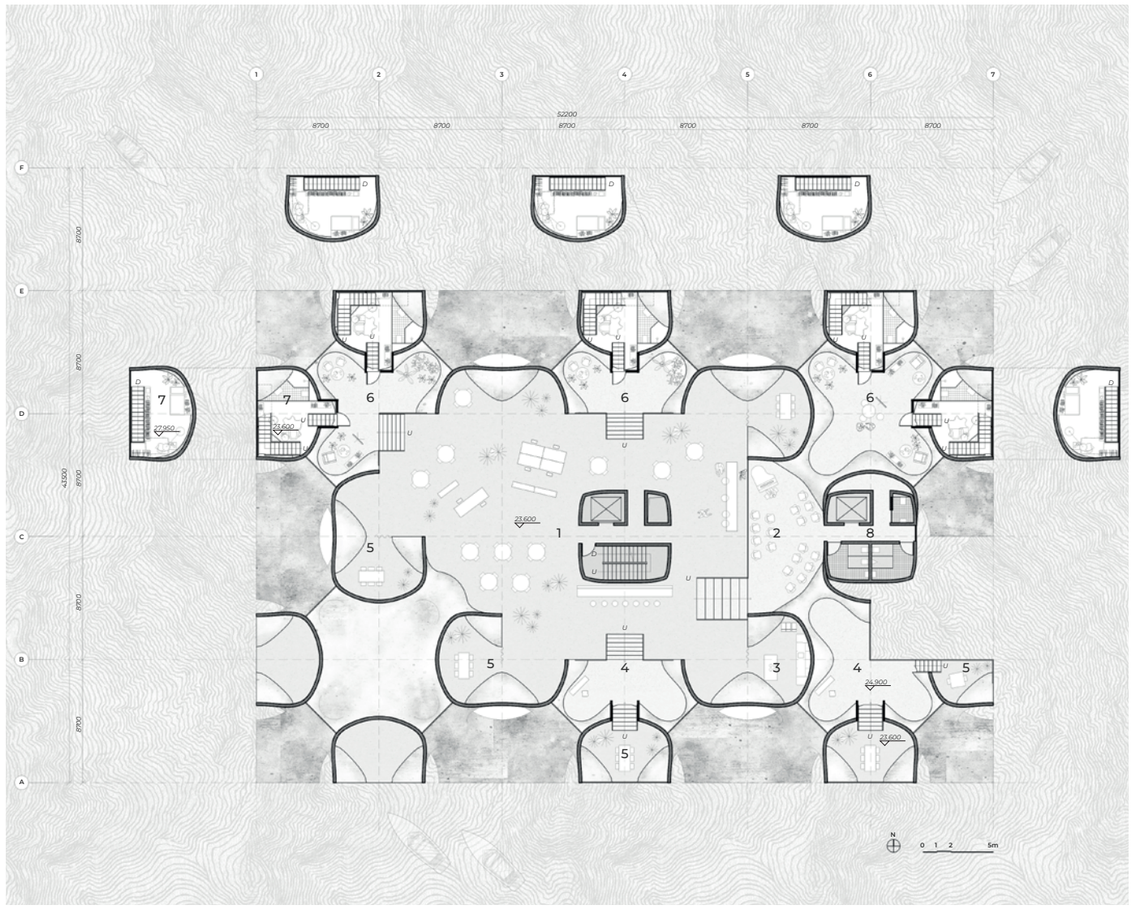


1. Public Area
2. Meeting Room
3. Discussion Balcony
4. Public Area
5. Residence with Open Lab Area
6. Private Resting Platform
7. Toilets

FORMATION OF DIAGONAL VISUAL CORRIDORS

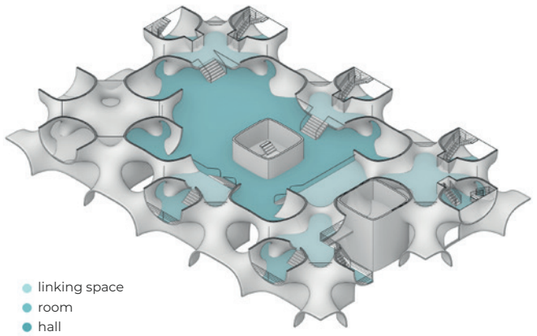
Formation Through Structural Design

The diagonal structure of the minimal surface forms elliptical voids, creating interconnected spaces that enhance public flow and interaction. Meanwhile, horizontal and vertical flow facilitate smooth transitions from semi-private to private spaces. These voids also establish a visual corridor, adding cohesion and rhythm to the building. This arrangement blends functionality with aesthetics, creating a dynamic environment that seamlessly integrates communal and private areas, ensuring a harmonious flow throughout the space.



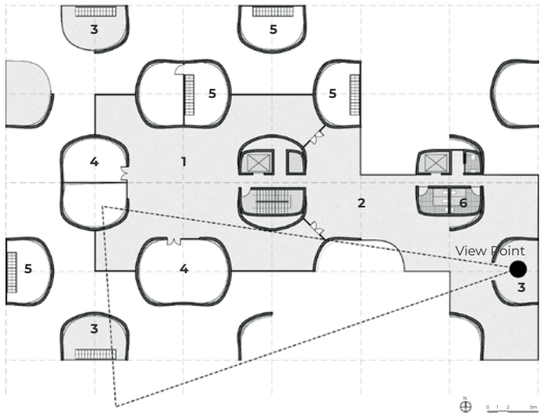
ENCLOSURE AND SIZING OF FUNCTIONAL AREAS

Sixthfloor Plan



1. Sky Café & Restaurant
2. Performance Platform
3. Kitchen
4. Serving Platfrom
5. Private Balcony
6. Semi-public Space
7. Residence Loft
8. Toilets

By removing select minimal surface modules, large open spaces are created with small semi-enclosed rooms along the edges. A 1.3-meter height difference distinguishes the central area from the peripheral balcony rooms, enhancing spatial size and privacy. This elevation also assigns specific service functions, creating a dynamic flow between the open central space and intimate edge rooms, resulting in a versatile and adaptable environment.

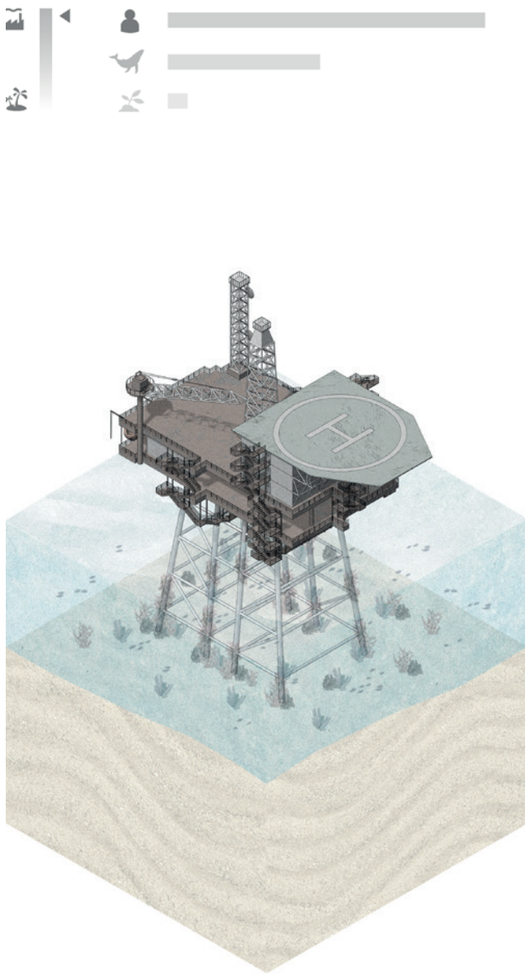


1. Indoor Exhibition Hall
2. Outdoor Exhibition Hall
3. Public Resting Balcony
4. Exhibition Room
5. Laboratory
6. Toilets

DEFINING HUMAN-NATURE CONNECTIONS

Formation Through Material

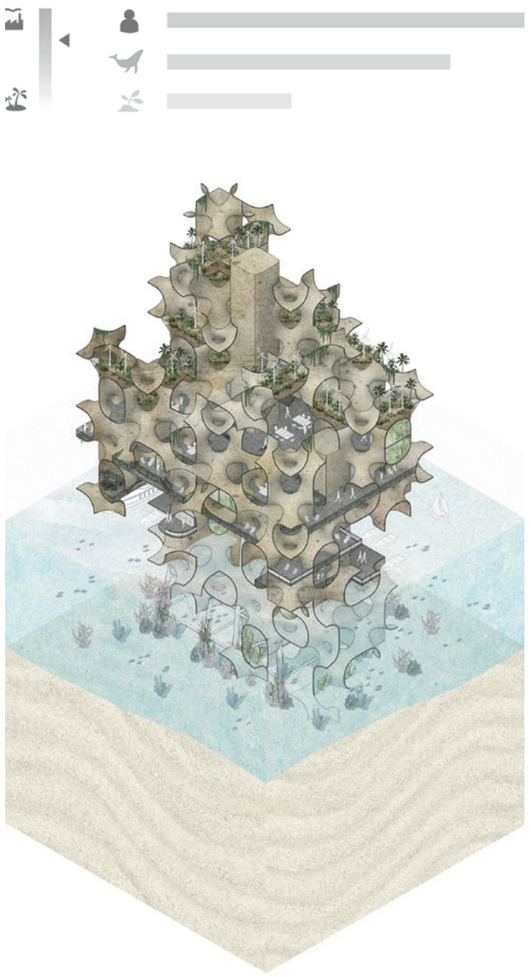
The design leverages the site's pleasant climate by incorporating natural ventilation and numerous viewing platforms along the edges for stunning sea views. Open outdoor museums on the second and third floors enhance the visitor experience, complemented by climbing vines and algae on glass surfaces. From these platforms, visitors can enjoy the sea breeze, listen to the waves, and take in the natural beauty where the sea meets the sky.



Oil Platform

Present

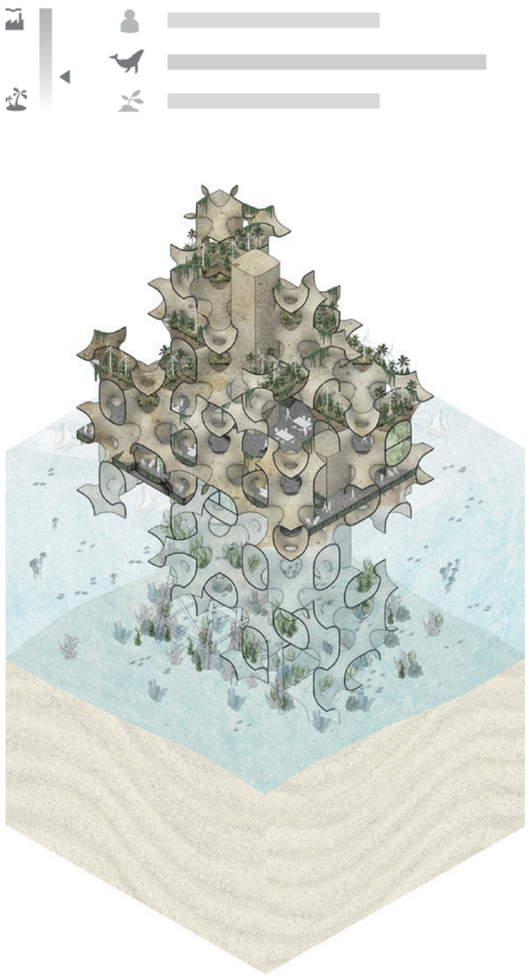
Currently, the above-sea portion of the oil platform houses infrastructure and personnel support, while below, the steel framework has become an artificial coral reef, integral to marine life. Removing these structures would be costly and disruptive, making repurposing essential to extend their usefulness and minimize environmental impact.



Research Center & Public Museum

Phase 01

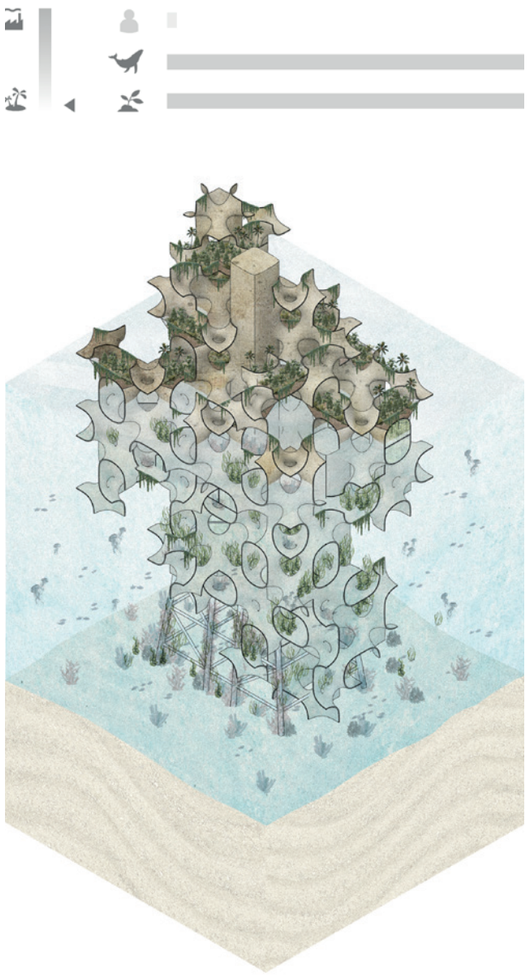
In the initial phase of the design, the building served primarily as a public museum and a small research institute. The areas intended for the general public were strategically placed on the floors closest to sea level, ensuring easy access and maintaining separation from the research and living spaces located on the upper floors. This layout allows the public spaces to be accessible and welcoming while keeping the research and living areas undisturbed and private.



Healing Center

Phase 02

As sea levels rise and land sinks, public spaces like museums gradually submerge. The floor slabs made of sand and organic adhesive slowly dissolve in the seawater, marking the building's transition into a healing center. With upper floors preserved as living and public spaces, the structure requires minimal changes for its new purpose. This foresight ensures the building adapts smoothly, maintaining its function and relevance despite shifting environmental conditions.



Oasis at Sea

Phase 03

As sea levels continue to rise and the land settles further, spaces designed for human use will submerge, with floor plates dissolving in seawater. Over time, algae cultivation and top gardens will introduce more greenery. The structure will then reach its final stage, becoming a sea ecological oasis. Transitioning from human activity to supporting nature, the building will foster biodiversity and contribute to Earth's ecological balance.

POSITIVE AND NEGATIVE SPACES:
MECHANICAL SYSTEMS MEET ORGANIC MORPHOSURFACES

A-A' Section Parallel View

1. Cafe
2. Equipement Storage
3. Indoor Exhibition Hall
4. Exhibition Room
5. Outdoor Exhibition Hall
6. Semi-Public Resting Platfrom
7. Public Area For 3 Residences
8. Residence with Open Lab Area
9. Private Resting Platform
10. Public Lab
11. Viewing Platform
12. Sky Café & Restaurant
13. Private Balcony
14. Performance Platform
15. Serving Platform
16. Underwater Lab
17. Lab Tank

Minimally surface structures create a series of small spaces with elliptical sections or plans. These elliptical spaces, representing the positive spaces of the layout, are carefully crafted to serve various purposes, ranging from private residences to specialized lab rooms. Surrounding these elliptical areas are larger, open spaces that are predominantly dedicated to public functions. These expansive zones are integrated with a traditional floor mechanics system, which provides the necessary infrastructure and support for the building's operations.

The intersection of the organic morphosurfaces with the mechanical systems is clearly articulated in the A-A' senction parallel view of the design. Here, the mezzanine level is strategically employed as a piping and utility space, ensuring that essential services are efficiently accommodated without disrupting the functional areas below or above.

Phase 03

Phase 02

Phase 01

A

A'