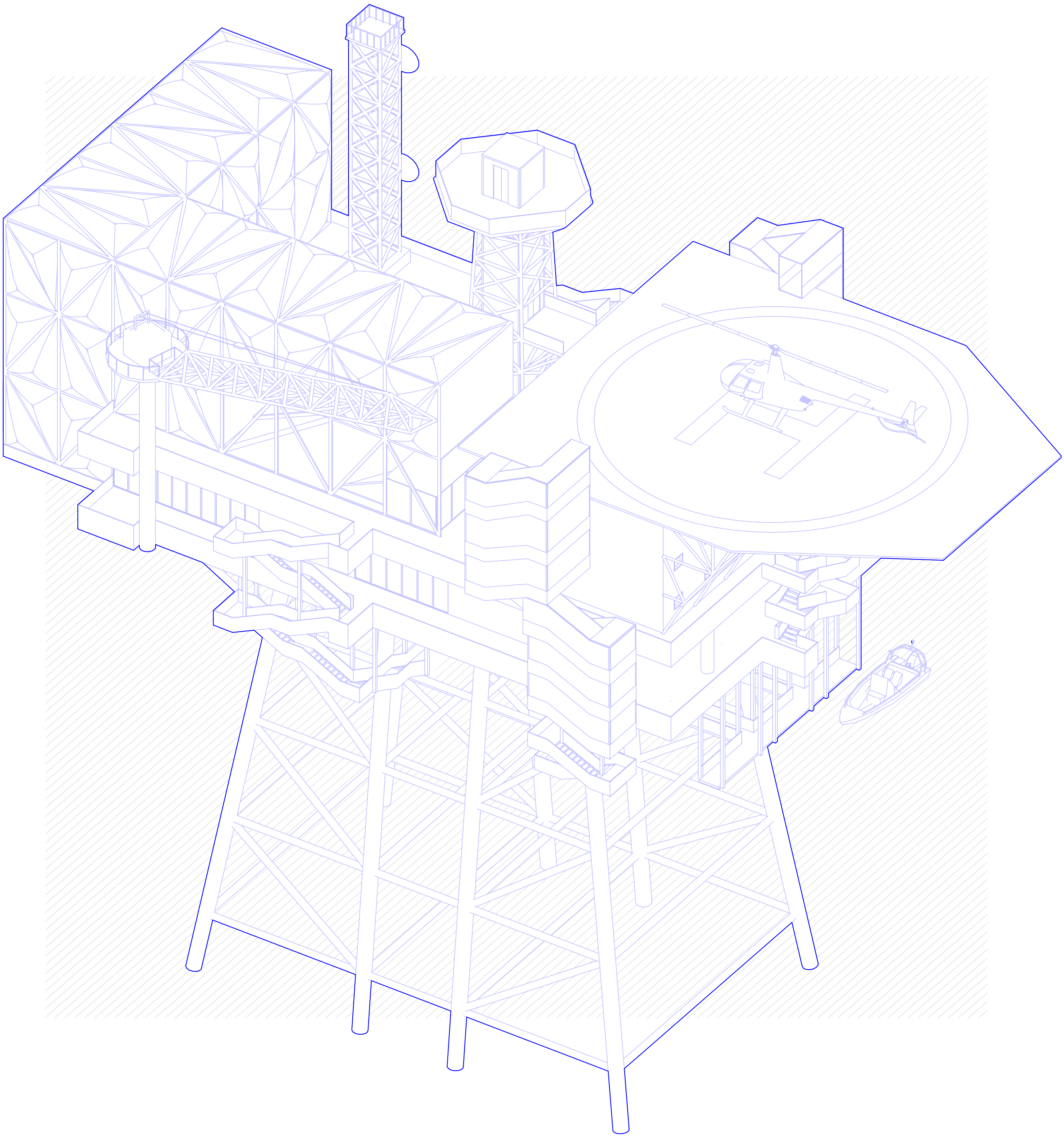

IRON ISLAND

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2024

Iron Island

Diploma project

Faculty of Architecture,
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CONTENT:

00

INTRODUCTION

Figure 3 - Rubjerg Knude Lighthouse [2].

Figure 1 - An aerial image shows the Principality of Sealand.

Figure 2 - Concept of the offshore theme park "The RIG" in Arabian Gulf, Saudi Arabia [1].

This architectural thesis explores the transformation of a forgotten industrial giant: a decommissioned oil platform in the Adriatic Sea. Inspired by the YAC (Young Architects Competitions) competition brief, which challenged architects to reimagine the future of such structures, this project envisions the platform's rebirth as a cutting-edge marine research center.

Around the world, we're seeing a growing movement to repurpose abandoned structures, breathing new life into relics of the past. From Saudi Arabia's ambitious "The RIG," an amusement park being constructed on a former oil platform, to the Principality of Sealand, a micronation established on a repurposed sea fort, these projects demonstrate the potential of adaptive reuse. This thesis aligns with this global trend, recognizing the unique opportunity presented by the Adriatic platform's location and inherent structural strength.

The Adriatic Sea, while captivating, faces increasing environmental challenges. This project sees the platform not as a symbol of past resource extraction but as a future hub for understanding and protecting the delicate marine ecosystem. The thesis delves into the architectural, environmental, and social considerations of this transformation, ultimately proposing a sustainable future for a structure poised to become a beacon of marine research.

01

GLOBAL CLIMATE CHANGES

1.1 GLOBAL CLIMATE CHANGES

Our planet is warming due to human activities that release greenhouse gases, trapping heat like a blanket. This rise in global temperature disrupts weather patterns, causing more extreme events like heatwaves, droughts, floods, and rising sea levels. These changes threaten human health, food security, ecosystems, and economies. International cooperation is key to tackling this global challenge.

Global climate changes threaten the following UN Sustainable Development Goals stated in [4]

- **Human health (SDG 3: Good Health and Well-being)** - Heatstroke, respiratory problems, and disease spread due to warmer climates.
- **Food security (SDG 2: Zero Hunger)** - Disrupted agricultural production caused by extreme weather events like droughts and floods.
- **Ecosystems (SDG 14: Life Below Water & SDG 15: Life on Land)** - Rising temperatures, ocean acidification, and habitat loss harm plant and animal life.
- **Economies (SDG 8: Decent Work and Economic Growth)** - Infrastructure damage from floods and storms, disruption of tourism industries, and strain on healthcare systems.

This project directly contributes to achieving several SDGs related to the marine environment:

- Combating Climate Change (SDG 13: Climate Action)
- Protecting Marine Ecosystems (SDG 14: Life Below Water)
- Transitioning to Clean Energy (SDG 7: Affordable and Clean Energy)

Impact of climate change on the World Ocean:

- Water temperature rise.
- Ocean acidification.
- Sea level rise.
- Changing frequency and intensity of extreme weather events.

Consequences of climate change for marine ecosystems:

- Loss of biodiversity.
- Decreased productivity.
- Spread of invasive species.
- Changing food chains.

1.2 THE IMPACTS OF CLIMATE CHANGE

A. Rising global temperatures

While the Earth's climate naturally fluctuates through periods of warming and cooling, the current trend of rising global temperatures is unprecedented in human history and undeniably linked to human activities. The burning of fossil fuels (coal, oil, and natural gas) for energy, industrial processes, and deforestation release immense quantities of greenhouse gases, primarily carbon dioxide, into the atmosphere. These gases trap heat from the sun, preventing it from escaping back into space, much like the glass panels of a greenhouse. This amplified greenhouse effect is the primary driver of global warming, with the ocean absorbing approximately 90% of this excess heat. The consequences of this warming are profound and far-reaching, impacting every aspect of the marine environment.

B. Ocean heat content

The ocean has absorbed about 90% of the excess heat generated by human-caused global warming, acting as a massive heat sink. While this may seem beneficial in the short term, it leads to devastating consequences. Marine heatwaves, prolonged periods of unusually high water temperatures, are becoming increasingly common, disrupting marine ecosystems, causing coral bleaching, and impacting fisheries. As waters warm, marine species are forced to migrate in search of suitable temperatures, disrupting delicate food webs and ecosystem balances. This warming also fuels more intense storms, with warmer ocean water providing more energy for hurricanes and cyclones to strengthen.

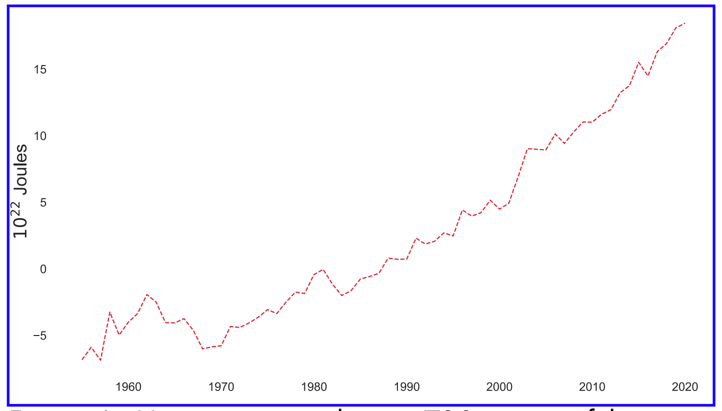


Figure 4 - Heat content in the top 700 meters of the world's oceans, 1955–2020 [5]

C. Sea level rise

As the ocean absorbs more heat, it expands in volume, leading to rising sea levels. This thermal expansion is compounded by the melting of glaciers and ice sheets, which add enormous volumes of freshwater to the ocean [6]. The consequences of sea level rise are already being felt around the world. Coastal areas face increased flooding, displacing communities, and damaging critical infrastructure. Erosion rates accelerate, with heightened wave action and storm surges eroding coastlines, putting homes and habitats at risk. Additionally, saltwater intrusion threatens freshwater sources, contaminating drinking water supplies and impacting agriculture.

D. Ocean acidification

The ocean plays a critical role in absorbing approximately 30% of the carbon dioxide released by human activities [7], mitigating the pace of atmospheric warming. However, this absorption comes at a cost of ocean acidification. As CO_2 dissolves in seawater, it forms carbonic acid, as shown in Figure 5, increasing the ocean's acidity. This poses a significant threat to marine life, particularly organisms that rely on calcium carbonate to build their shells and skeletons. Corals, shellfish, and plankton struggle to thrive in more acidic water, leading to cascading effects throughout marine food webs.

E. Ocean deoxygenation

As the ocean warms, its capacity to hold dissolved oxygen decreases. Additionally, warmer surface waters mix less effectively with cooler, deeper waters, further reducing oxygen supply to the depths. This process, known as ocean deoxygenation, has severe consequences for marine life. "Dead zones," areas with dangerously low oxygen levels, are expanding, suffocating marine organisms and decimating habitats. Many species are forced into increasingly smaller areas with adequate oxygen, intensifying competition for resources and threatening biodiversity.

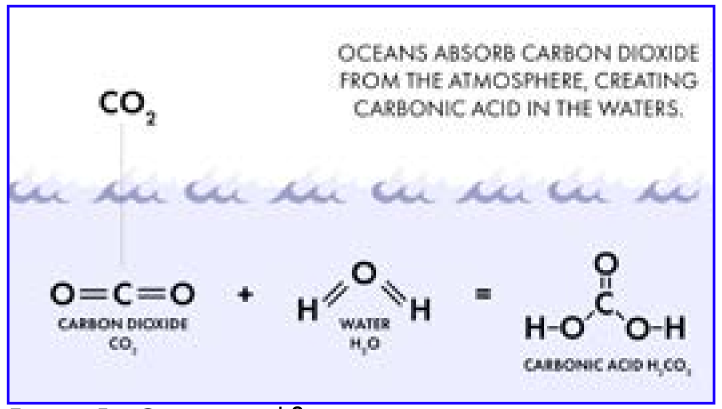


Figure 5 - Ocean acidification.

1.3 HUMAN IMPACTS

A. Overfishing

Overfishing, driven by our insatiable appetite for seafood, is pushing many fish populations to the brink of collapse. By hauling in fish faster than they can reproduce, we disrupt the delicate balance of the ocean's ecosystems, leaving behind a cascade of unintended consequences. These include wiping out valuable fish stocks, accidentally killing other marine life like turtles and dolphins (bycatch), and even damaging the ocean floor with destructive fishing methods. This not only impacts the health of our oceans but also threatens the livelihoods of millions who depend on fishing for food and income.

B. Habitat destruction

Coastal development, pollution, destructive fishing practices, and climate change are bulldozing through essential habitats like coral reefs, mangrove forests, and seagrass meadows. These ecosystems provide food, shelter, and breeding grounds for countless marine species, and their destruction disrupts the delicate balance of life in our oceans. Without these crucial habitats, countless species face dwindling populations, pushing some closer to extinction and unraveling the intricate web of marine life.

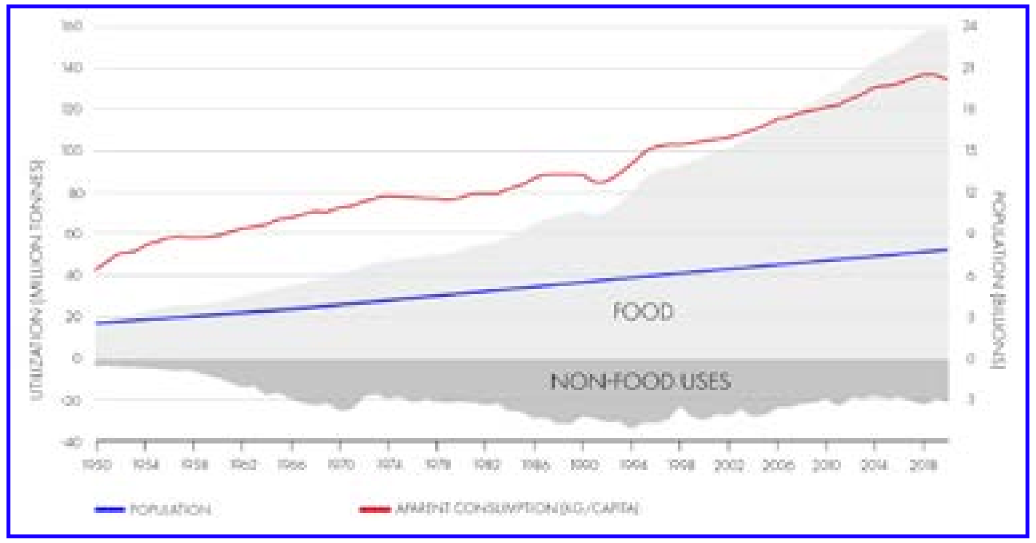


Figure 6 - Fish utilization with growing population [8].

C. Ocean pollution

Ocean pollution presents a significant threat to the health and sustainability of marine ecosystems. This pollution stems from a multitude of sources and manifests in various forms, each with its unique set of consequences for marine life and the delicate balance of the ocean environment.

Key Types and Impacts of Ocean Pollution

- **Plastic pollution:** The spread of plastic debris in the ocean, ranging from large discarded items to microscopic particles, poses a grave danger to marine organisms. Ingestion of plastic by marine animals can lead to starvation, internal injuries, and entanglement, ultimately resulting in their death. The persistence of plastic in the marine environment, taking hundreds of years to degrade, exacerbates this pervasive threat.
- **Chemical contamination:** Industrial discharges, agricultural and improperly treated wastewater introduce a vast array of chemicals into the ocean, including heavy metals, pesticides, and pharmaceuticals. These pollutants can have toxic effects on marine life, disrupt endocrine systems, and bioaccumulate in the food chain, potentially reaching humans who consume seafood.
- **Nutrient pollution:** Excessive nutrient input from agricultural fertilizers and sewage discharges disrupts the natural balance of nutrients in the ocean, leading to a process called eutrophication. This overabundance of nutrients fuels algal blooms, which deplete oxygen levels as they decompose, creating hypoxic "dead zones" where marine life cannot survive [9].
- **Noise pollution:** Anthropogenic noise pollution from shipping traffic, seismic exploration, and sonar systems disrupts the acoustic environment of the ocean. This noise can interfere with the communication, navigation, and foraging behavior of marine animals, particularly those that rely on sound for essential life functions.
- **Oil pollution:** Accidental spills from oil tankers or offshore drilling platforms release large quantities of oil into the marine environment, resulting in catastrophic consequences. Oil spills can suffocate marine life, poison ecosystems, and cause long-term damage to coastal habitats, affecting tourism, fishing, and overall ecological integrity.

02

ADRIATIC SEA

2.1 MAIN CHARACTERISTICS

The Adriatic Sea is a significant body of water that separates the Italian Peninsula from the Balkan. It is a distinctive part of the Mediterranean Sea, known for its extensive continental shelf and varying depths.

A. Geographical dimensions
The Adriatic Sea stretches over 800 kilometers in length and varies in width between 150 to 200 km. It covers a surface area of approximately 138,600 km2 and contains a volume of about 35,000 km3. The sea's orientation follows a major axis from the northwest to the southeast.

B. Continental shelf and basin division
The Adriatic Sea is notable for having the most extensive continental shelf in the central Mediterranean region. The basin is divided into three distinct sections, each with unique features:

- **Northern Adriatic:** This section represents 5% of the basin and is relatively shallow, with a maximum depth of 75 meters and an average depth of around 35 meters. It is essentially the submerged part of the Po Plain.

- **Central Adriatic:** Making up 15% of the basin, the central Adriatic has an average depth between 130 to 150 meters. It is also the location of the Pomo Depression, also known as the "Meso-Adriatic Trench" which reaches a depth of 270 meters.

- **Southern Adriatic:** The largest section, accounting for 80% of the total volume, the southern Adriatic has an average depth of 450 meters and a maximum depth of 1233 meters. It features a large bathyal basin and a narrow continental shelf at the Strait of Otranto.

Figure 7 - Bathymetric map of the Adriatic sea.

C. Coastal characteristics
The western Adriatic coast, along Italy, is characterized by low, sedimentrich beaches formed from significant river discharge during the Pleistocene to Holocene periods. In contrast, the eastern Adriatic coast is rugged and rocky. The seabed sediments of the Adriatic are predominantly sandy-muddy, with the main clastic sources found along the western side.

D. Tidal influence
In contrast to the rest of the Mediterranean Sea, where tidal influence is generally negligible, the northern Adriatic experiences significant tidal movements.

2.2 CLIMATE

A. Wind
The main winds that affect the Adriatic are the Bora, Jugo, Maestral, and others like Tramontana, Lebić, and Burin [11].

Figure 8 - Map of main windblows of the Adriatic sea.

B. Adriatic flows
The Adriatic Sea, a significant body of water separating the Italian Peninsula from the Balkan Peninsula, exhibits unique water flow characteristics.

- **Freshwater inputs**

The Adriatic Sea receives substantial freshwater from numerous rivers, with the Po River being the most significant contributor. Submarine springs along the Balkan coast also contribute to the freshwater inflow, impacting the overall water balance of the sea.

- **Water exchange with the Ionian sea**

The Adriatic Sea's entire volume is rapidly exchanged with the Ionian Sea through the Strait of Otranto, marking a significant hydrodynamic feature of this marine environment.

- **Ocean currents**

The prevailing currents in the Adriatic Sea flow in a counterclockwise direction, as shown in Figure 7, influenced by the seabed's topography and the underwater ridge at the Strait of Otranto.

- **Tidal movements**

Tidal movements in the Adriatic Sea, although generally slight, can have larger amplitudes in certain areas, contributing to the sea's unique hydrodynamics [12].

C. Temperature

The Adriatic Sea experiences a range of surface water temperatures throughout the year, which play a significant role in the climate of the surrounding regions.

Seasonal Temperature Variations

- **Summer:** Surface water temperatures can reach up to 30°C (86°F) [12], providing a warm and pleasant climate for beachgoers and marine activities.

2.3 BIODIVERSITY

The Adriatic Sea is a biodiversity hotspot, hosting a rich variety of marine species and unique ecosystems.

A. Species richness

The Adriatic Sea is home to nearly half (49%) of the recorded Mediterranean marine species. It is considered one of the richest seas in terms of species, while it is one of the poorest in terms of population density. Approximately 70% of known fish species in the whole Mediterranean Sea is recorded in the Adriatic [13].

B. Endemic flora and fauna

The Adriatic Sea is rich in endemic flora and fauna, contributing to its unique biodiversity. The northern Adriatic Sea, in particular, is known for its rocky outcrops called "trezze" or "tegnúe," which are recognized as biodiversity hotspots [14].

C. Invasive species

The Adriatic Sea has seen the arrival of nearly 50 invasive species over the past few decades, posing a threat to its biodiversity. These invasive species, such as the algae Caulerpa cylindracea and the lionfish, are bioindicators of changing environmental conditions [15].

D. Benthic communities

The Adriatic Sea hosts diverse benthic communities, including those found on soft and hard bottoms. These communities are home to a variety of species, including sea turtles, seabirds, sea mammals, and a wide range of fish species [16].

2.4 IMPACT OF THE GLOBAL CLIMATE CHANGES ON THE ADRIATIC SEA

Specifics of the Adriatic Sea:

- Enclosed sea.
- Limited water exchange with the World Ocean.
- High anthropogenic load.

A. Temperature changes

The Adriatic Sea is warming at a rate faster than the global average [15], with temperatures projected to continue rising in the coming decades. This warming is causing changes in ocean circulation patterns, affecting nutrient distribution and productivity.

Impacts on Coral Reefs

- **Bleaching:** Warmer waters force coral to expel beneficial algae, leading to bleaching and death, weakening reef structures.
- **Stunted Growth:** Warmer temperatures slow coral growth and reproduction, hindering reef recovery and expansion.
- **Increased Disease:** Higher temperatures weaken coral, making them more susceptible to diseases that accelerate decline [17].

Marine Life

- **Shifting Distribution:** As temperatures rise, fish may migrate to cooler waters, altering marine communities and food webs.
- **Disrupted Reproduction:** Warmer waters can affect spawning patterns and success rates, impacting fish populations.
- **Oxygen Depletion:** Warmer water holds less oxygen, stressing and harming marine life, especially bottom-dwellers.
- **Invasive Species Spread:** Warmer temperatures favor the establishment of invasive species, further threatening native biodiversity.

B. Rising Sea Levels

The Adriatic Sea is particularly vulnerable to sea level rise due to its shallowness and the landlocked nature of its catchment area. Increased sea levels are contributing to coastal erosion, inundation of low-lying areas, and saltwater intrusion into freshwater sources.

C. Ocean Acidification

Marginal seas like the Adriatic Sea, despite covering only 7% of the total ocean area, play a significant role in the global carbon budget due to their intensive CO_2 fluxes. The Adriatic Sea is currently a CO_2 sink, absorbing approximately -1.2 to -3 mol C m^{-2} yr^{-1} (moles of carbon per square meter per year), which is about half the absorption rate of the northwestern Mediterranean Sea.

The Adriatic Sea is also experiencing ocean acidification, a phenomenon caused by the absorption of excess carbon dioxide from the atmosphere. Ocean acidification is harming marine organisms, particularly calcifying organisms like corals and shellfish, which rely on calcium carbonate to build their shells and skeletons. Over a 25-year period, the northern Adriatic has experienced an acidification rate of 0.003 pH units per year, similar to the Mediterranean open waters and coastal waters [18].

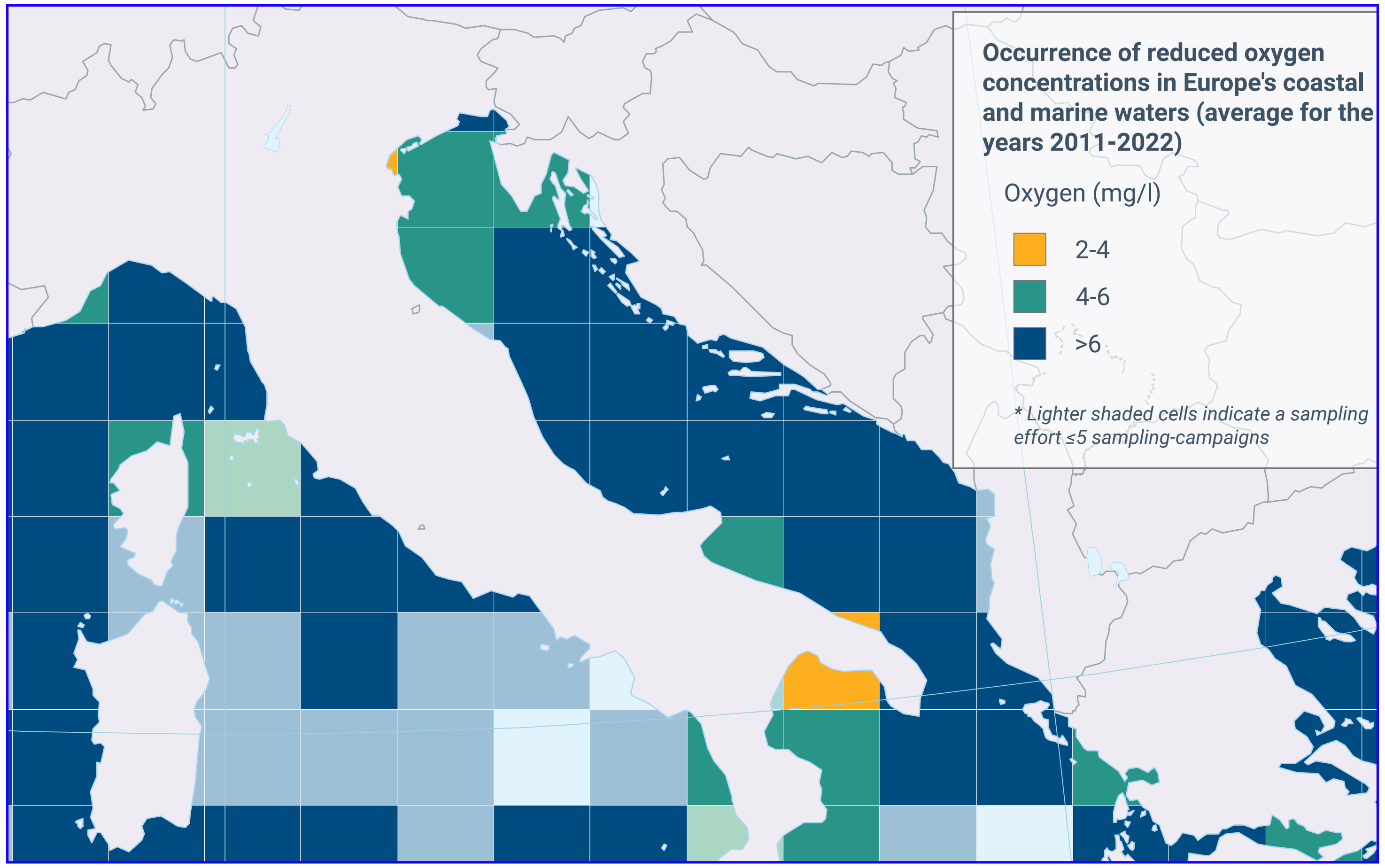


Figure 9 - Amount of dissolved oxygen in the Adriatic sea.

D. Deoxygenation

The Adriatic Sea is experiencing deoxygenation, a condition where oxygen levels in the water drop below levels required to support marine life. This deoxygenation is attributed to a combination of factors, including increased nutrient loading from human activities, eutrophication, and climate change. Northern adriatic has lower oxygen content than other parts of the sea as Shown in Figure 9.

E. Water quality

The quality of water in the Adriatic Sea, particularly in its northern part, is influenced by a variety of factors including pollution from point sources, sediment interactions, and the influx of nutrients and plastic waste. These factors collectively impact the marine environment, biodiversity, and the quality of bathing waters, which are crucial for the region's tourism and aquaculture sectors.

03

ADDRESSING THE SELECTED PROBLEMS

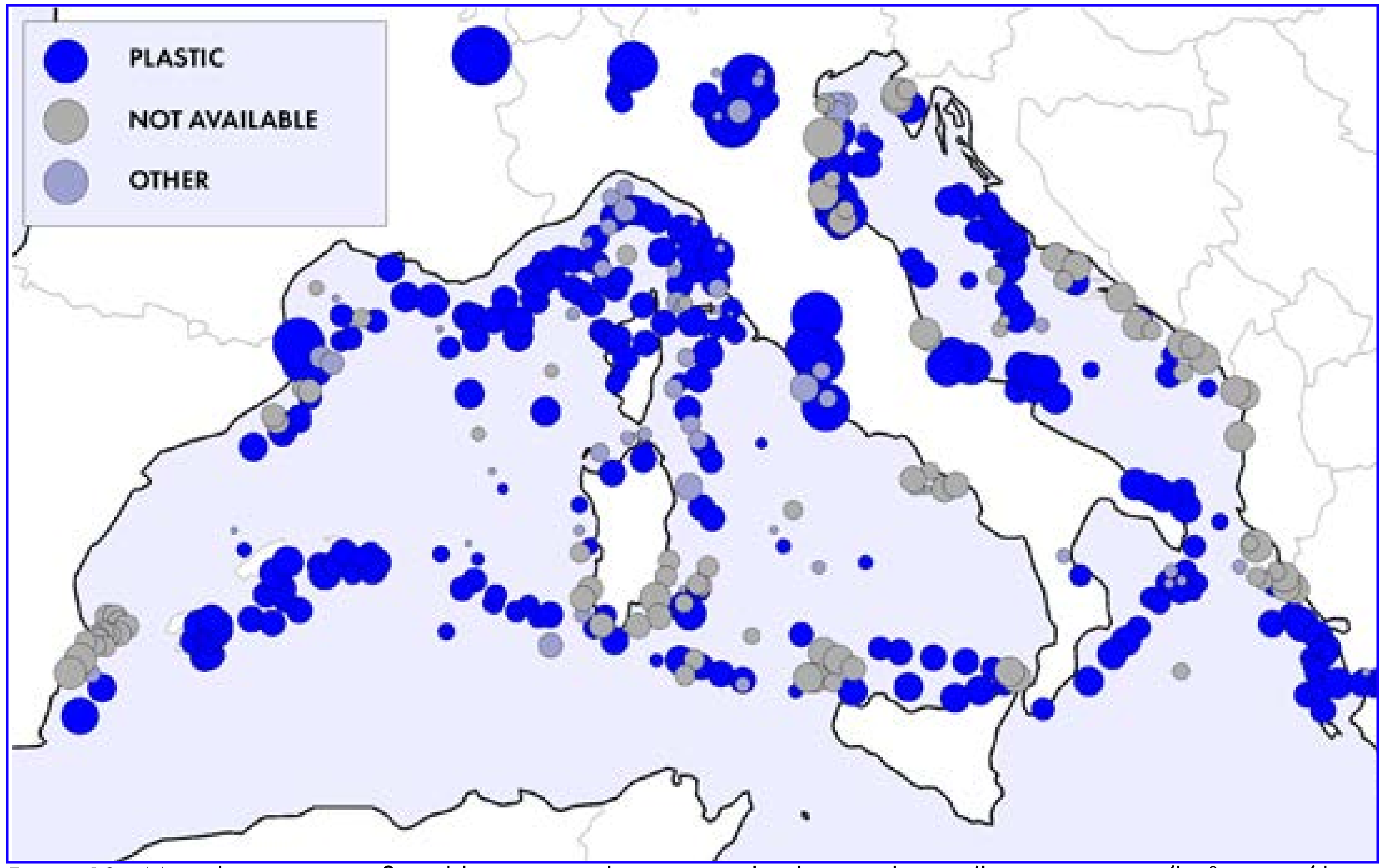


Figure 10 - Map showing scientific publications on the amount, distribution, density (litter unit: items /km^2; items / km; items / m^3) and composition of litter in the Mediterranean Sea [22].

3.1 MICROPLASTIC POLLUTION

A. Problem

Microplastics (MPs) are tiny plastic debris less than 5 millimeters in size that are a major pollutant in the marine environment. They are found throughout the marine environment, including surface water, sediments, and biota. The Adriatic Sea is a hotspot for plastic pollution due to its semiclosed conformation, oceanographic conditions, and heavy anthropogenic pressure.

MPs can be ingested by marine organisms, including fish, and can have both physical and chemical impacts. They can also act as vehicles for toxic chemicals, such as endocrine disrupting chemicals (EDCs). EDCs can disrupt the endocrine system of marine organisms, leading to a variety of adverse effects, including reproductive problems and metabolic alterations [19].

B. Several methods that can help to remove microplastic from marine environment

- **Physical Methods:**

Filtration: Upgrading wastewater treatment plants with finer filtration membranes could capture microplastics before they reach the ocean.

Centrifugation: High-powered centrifuges might separate microplastics from water based on their density, but this method is energy-intensive for large-scale use.

Magnetic Filtration: Introducing magnetized particles that attract microplastics, allowing for their removal through magnetic fields, is under development.

- **Biological Methods:**

Biodegradation: Certain microbes have shown promise in breaking down specific types of plastics. However, this field is still in its early stages and needs more research for large-scale application.

Mussels: When mussels filter microplastics from the water, these plastics are ingested along with their regular food and then incorporated into their faeces. The microplastics become bound within the faecal matter, which can then settle to the seabed. This process effectively removes the microplastics from the water column and isolates them in the sediment. Clusters of 300 mussels (5kg) could filter out over 250000 microplastic particles per hour [20]. The faeces containing microplastics can be collected for removal, thereby taking microplastics out of the marine system entirely.

The study “Mussel power: Scoping a nature-based solution to microplastic debris” by Matthew Cole et al. [21] explores the potential of using mussels as a nature-based solution to mitigate microplastic pollution in aquatic environments.

Modeling predicted that mussels located at the mouths of estuaries could remove about 4% of microplastics emanating from nearby rivers. The study provides evidence that mussels can effectively remove microplastics from water and encapsulate them into biodeposits (faeces and pseudofaeces), which can then be collected and removed from the environment.
This project will examine the potential benefits and challenges of using mussels as a natural solution to address microplastic debris in aquatic ecosystems.

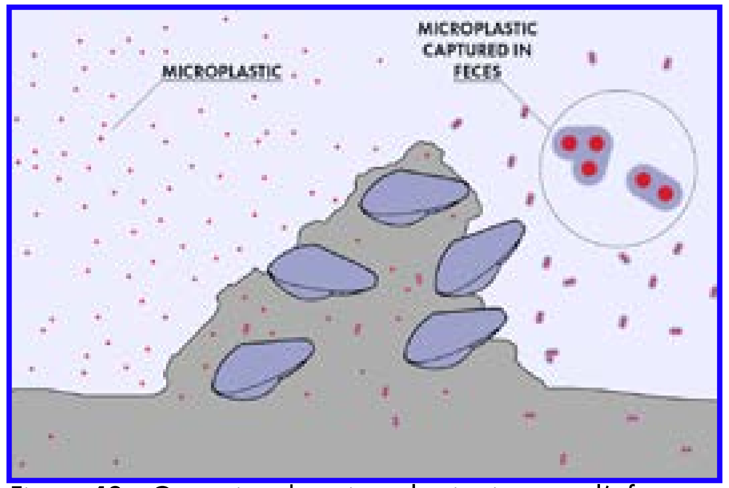


Figure 12 - Capturing the microplastics in mussel's feces.

3.2 ACIDIFICATION

A. Selected methods that can help to capture CO_2

- **Mechanical method**

A startup called Equatic [23] that has developed a technology to address two key environmental concerns: capturing carbon dioxide (CO_2) from the ocean and producing green hydrogen fuel.

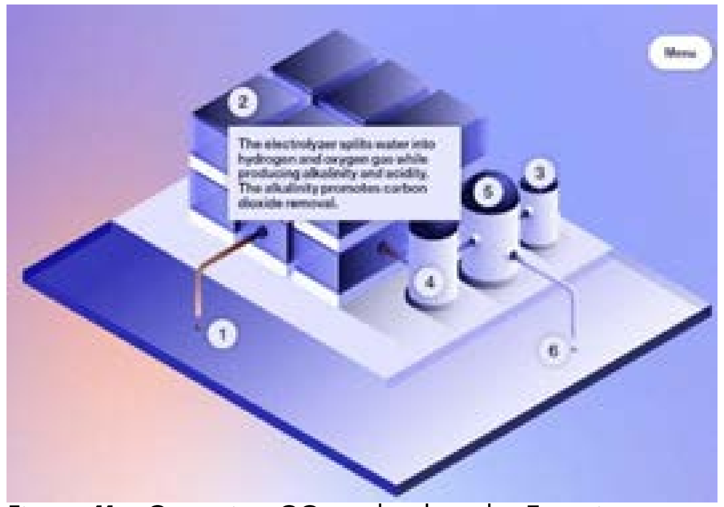


Figure 11 - Capturing CO_2 technology by Equatic.

The potential benefits of this technology:
Reduced atmospheric CO_2: By capturing CO_2 from the oceans, Equatic aims to contribute to mitigating climate change, by increasind the ocean's absorption capabity.
Clean energy source: The green hydrogen produced can be used as a clean fuel alternative, reducing reliance on fossil fuels.
Cost-effectiveness: The company suggests their technology offers a potentially cost-effective solution for CO_2 capture and sequestration.

- **Biological methods:**

Seagrass meadows play a crucial role in mitigating the effects of ocean acidification on calcifying algae, enhancing their calcification rates and resilience. These underwater plants also contribute significantly to carbon sequestration, both within and beyond their habitats, potentially affecting carbon storage in deep-sea sediments. Despite the benefits, seagrass ecosystems face threats from human activities and climate change, with global seagrass stocks declining annually [24]. Conservation efforts are essential to maintain the ecosystem services provided by seagrass, including biodiversity support, climate change mitigation, and coastal protection.

Algae's photosynthetic CO_2 absorption
Algae, encompassing microalgae and macroalgae, contribute to mitigating ocean acidification through photosynthesis. By converting CO_2 and water into glucose and oxygen, algae remove CO_2 from both the atmosphere and ocean, potentially reducing acidifica tion.

The method chosen for this project was to cultivate algae for carbon capture emerges as a promising strategy to combat climate change and ocean acidification. Algae can capture nearly twice their weight in CO_2, and utilizing algae biomass for biofuels or other products can further reduce greenhouse gas emissions.

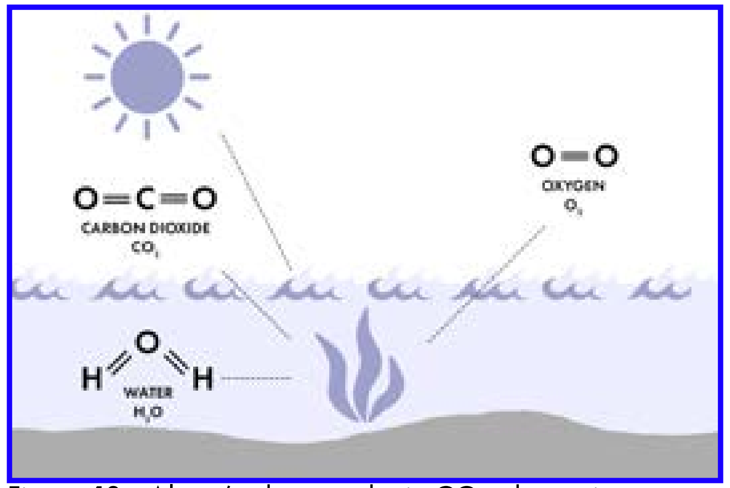


Figure 13 - Algae's photosynthetic CO_2 absorption

3.3 GLOBAL THREATS TO CORAL REEFS

Rising ocean temperatures and ocean acidification are the primary global threats to coral reefs. Warmer seawater causes coral bleaching, where corals expel vital algae (zooxanthellae) and lose their color, leading to increased vulnerability and potential death [25]. Ocean acidification, due to higher CO_2 levels, reduces the availability of carbonate ions needed for coral skeletons, hindering growth and potentially causing dissolution. These conditions are exacerbated by climate change and human activities, threatening the survival of these critical marine ecosystems.

Artificial reefs
Coral reefs, the colorful underwater cities, are in trouble. To help them out, people are building special underwater structures called artificial reefs. These reefs can be made from lots of different things, like rocks or special concrete, and look like all sorts of shapes.

Early attempts and the learning curve (1970s-1980s)
Early artificial reef projects, utilizing readily available resources like broken ships and vehicles, yielded mixed results. Success depended on factors such as material stability, toxicity, and the ability to create diverse habitats for marine life. Additionally, some misguided attempts to use artificial reefs for waste disposal caused environmental damage and negatively impacted public perception of these projects. These early experiences provided valuable lessons, shaping the evolution of artificial reef design and construction practices towards more ecologically sound and effective approaches.

Modern practices and goals
Purposeful design and deployment with non-toxic, durable materials prioritize surface area and structural complexity.

Key goals include:

- Restoring lost structure and habitat diversity.
- Expanding reef size and enhancing local marine resources.
- Creating alternative dive/snorkeling sites to alleviate pressure on natural reefs.
- Raising awareness and communicating reef issues through artistic expressions.

Traditional materials and their advantages
Metal shipwrecks and oil platforms: These large structures unintentionally serve as artificial reefs, providing a solid base for coral and other marine organisms to flourish.
Concrete: This material is favored for its durability, affordability, and resemblance to natural coral limestone. Additionally, modular concrete units offer flexibility in deployment and promote coral attachment.

Addressing concerns and alternative materials
Mixed metal alloys: The rapid degradation of these alloys due to saltwater corrosion makes them less suitable for long-term reef projects.

The future of artificial reefs
Mineral Accretion Devices (Electrified Reefs): These devices utilize electricity to accelerate coral growth by precipitating minerals directly onto the structure.

Promising techniques
3D printing: This technology offers the potential for precise and customized reef structures.
Art integration: The incorporation of art elements into reef structures can create unique and visually appealing ecosystems.

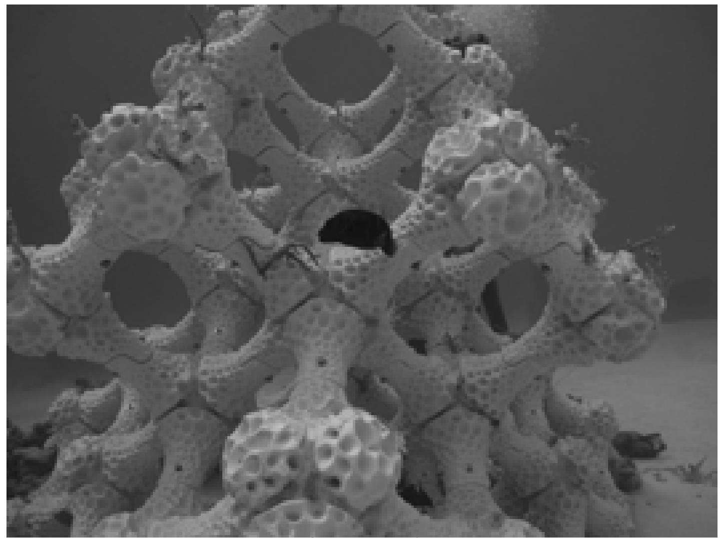
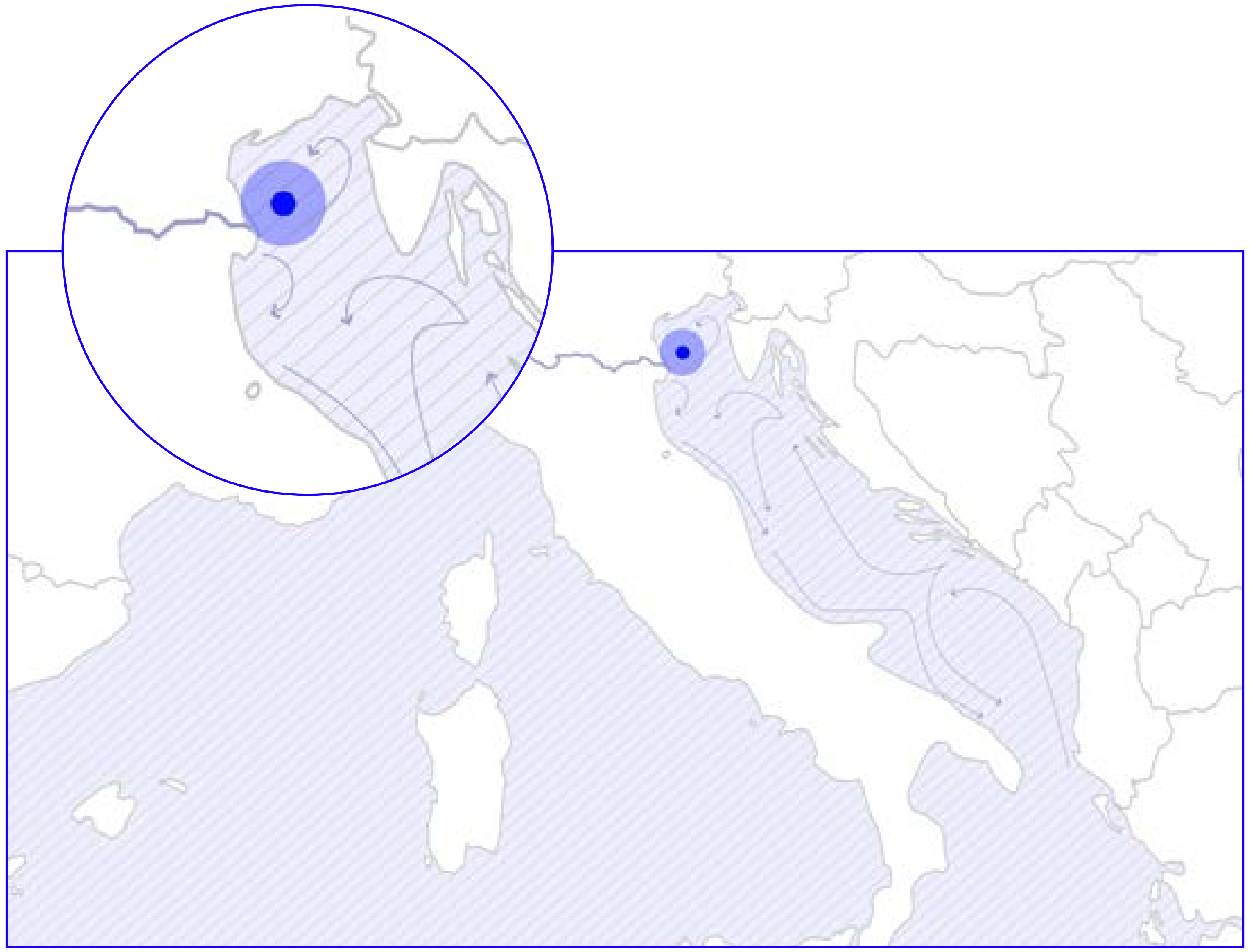


Figure 14 - Modular artificial reef structure [26].

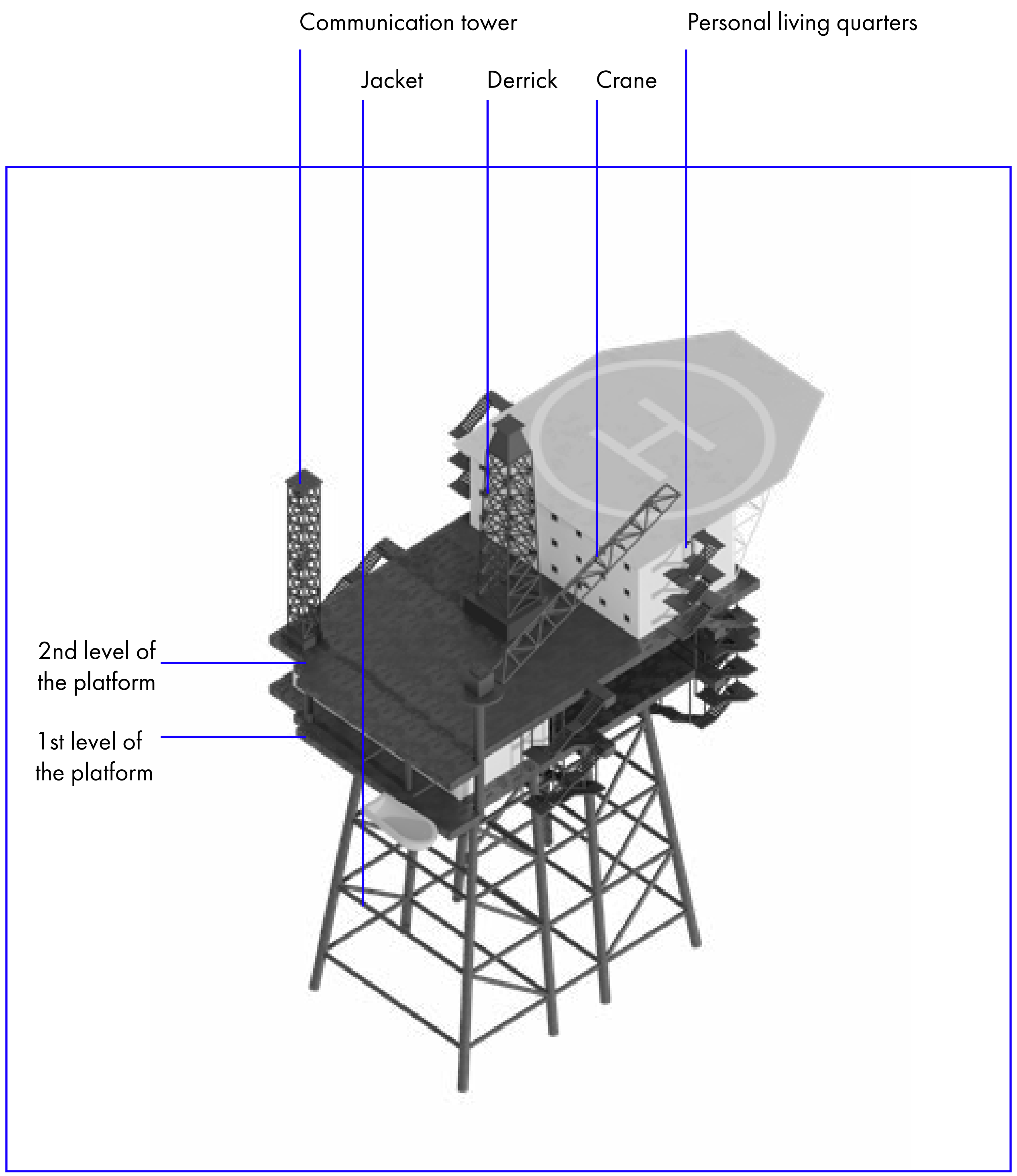

Figure 15 - Underwater museum in the Gulf of Mexico [27].

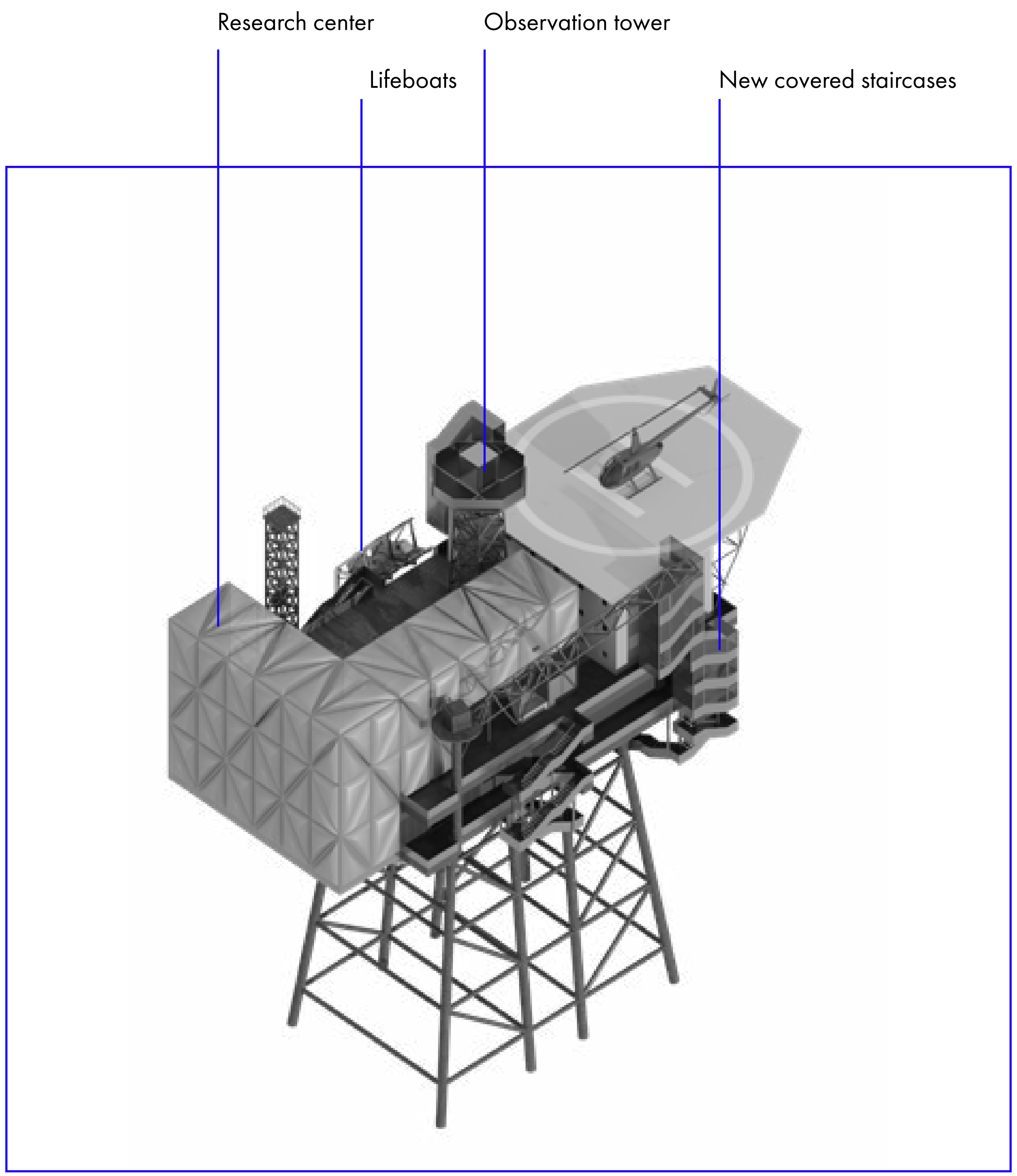
04
CONCEPT DEVELOPMENT

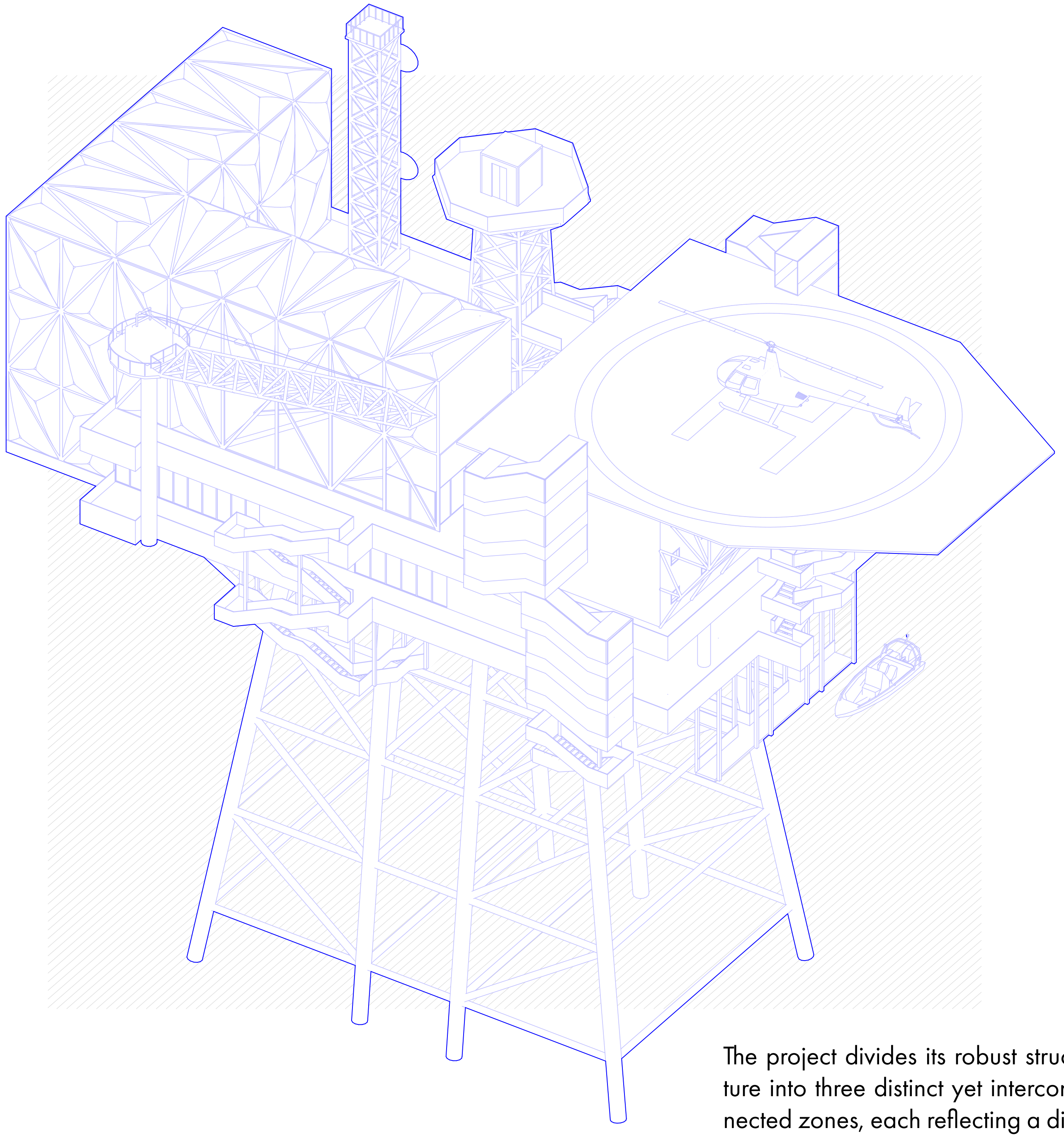
Of all the potential locations, this particular site in the northern Adriatic Sea, off the coast of Italy, emerged as the most compelling. This region faces significant environmental challenges, largely due to its proximity to the city of Venice, the mouth of the Po River, and the swirling patterns of the Adriatic Sea. These factors converge to create an unfortunate trifecta, making this area particularly vulnerable to marine pollution.
For instance these factors result in a concerning concentration of pollutants in this zone. This site, therefore, presents a unique opportunity—a critical location to study the impacts of pollution and develop innovative solutions for mitigation and remediation.



This architectural project reimagines an Adriatic oil platform as a cutting-edge marine research center, showcasing the potential for adaptive reuse in even the harshest environments. Rather than demolishing this industrial giant, the design sees its robust structure and unique location as assets, transforming the platform into a symbol of environmental stewardship and scientific discovery.


Communication tower
Jacket
Derrick
Crane
Personal living quarters
2nd level of the platform
1st level of the platform

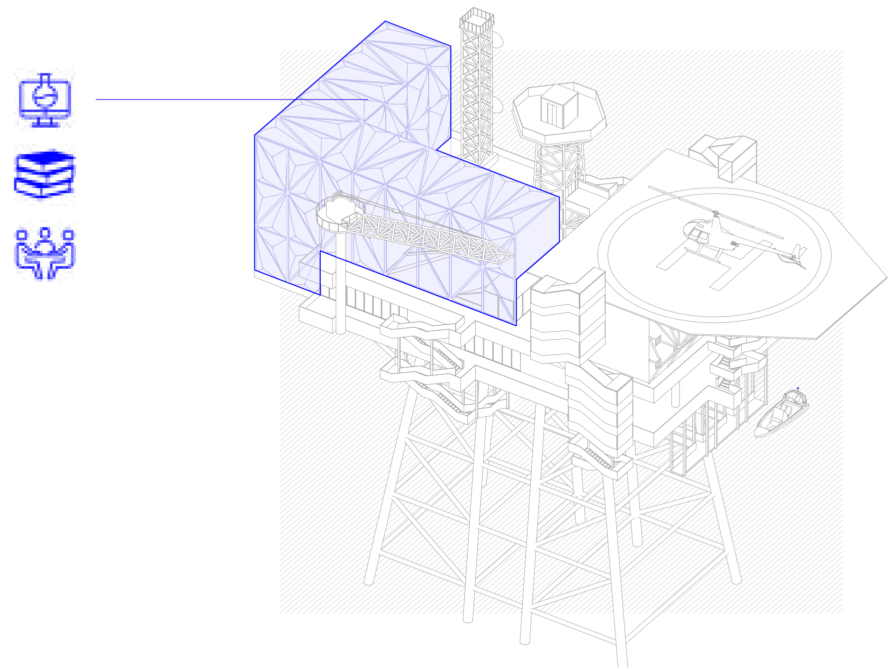

Research center
Lifeboats
Observation tower
New covered staircases



The project divides its robust structure into three distinct yet interconnected zones, each reflecting a different facet of its new identity

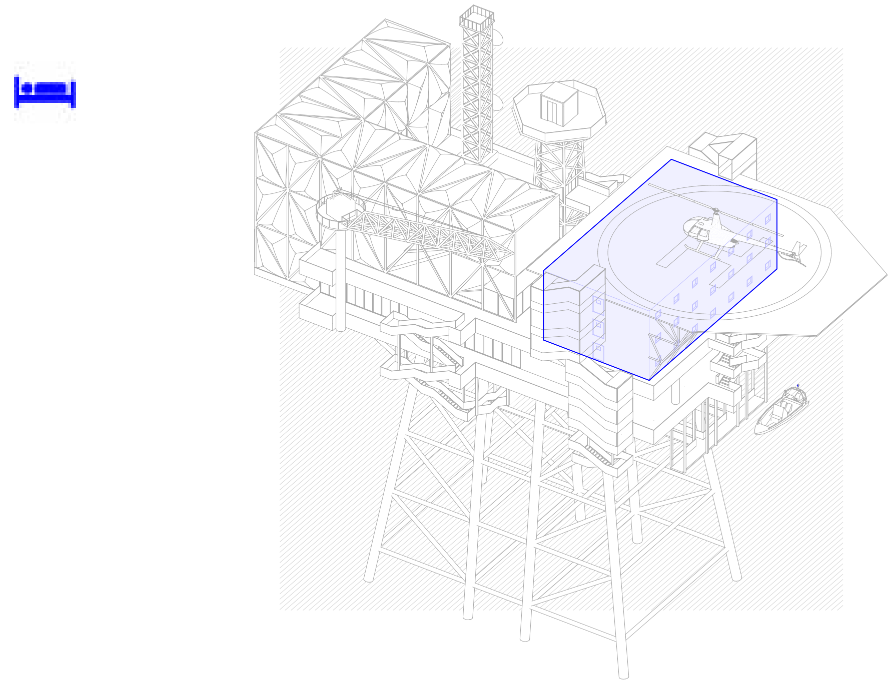
The Inquiry

The platform's heart beats with the pulse of scientific exploration. This central zone repurposes the former industrial spaces into state-of-the-art laboratories, workshops, and research facilities. Here, amidst the platform's repurposed machinery and rugged framework, cutting-edge technology meets the untamed power of the sea.



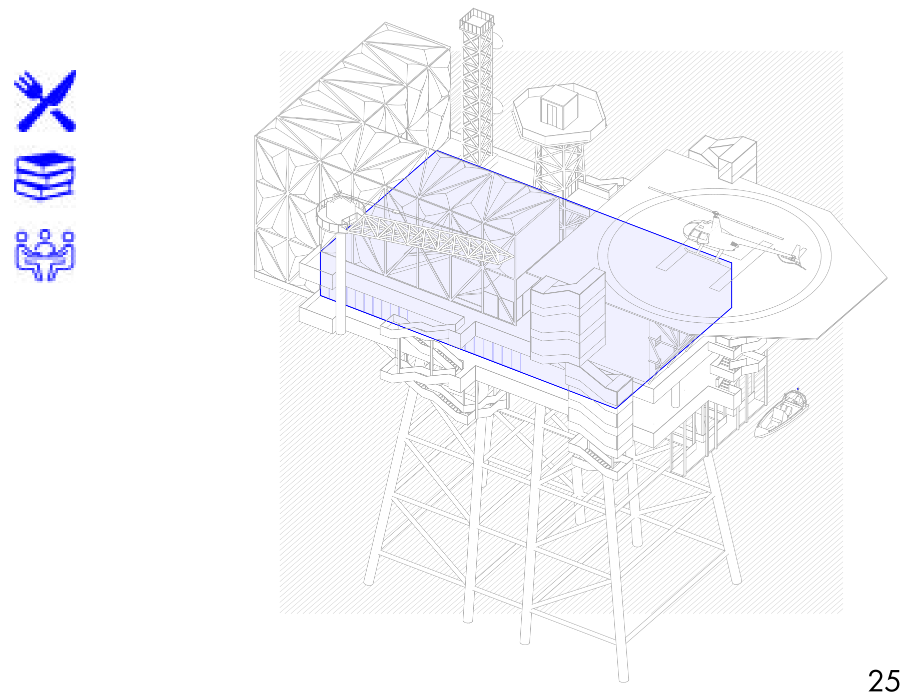
The Legacy

The existing residential quarters, once housing oil workers, now accommodate researchers and staff. These repurposed living spaces, with ocean views, foster a sense of community and provide a comfortable home for those dedicated to unraveling the mysteries of the marine world.



The Respite

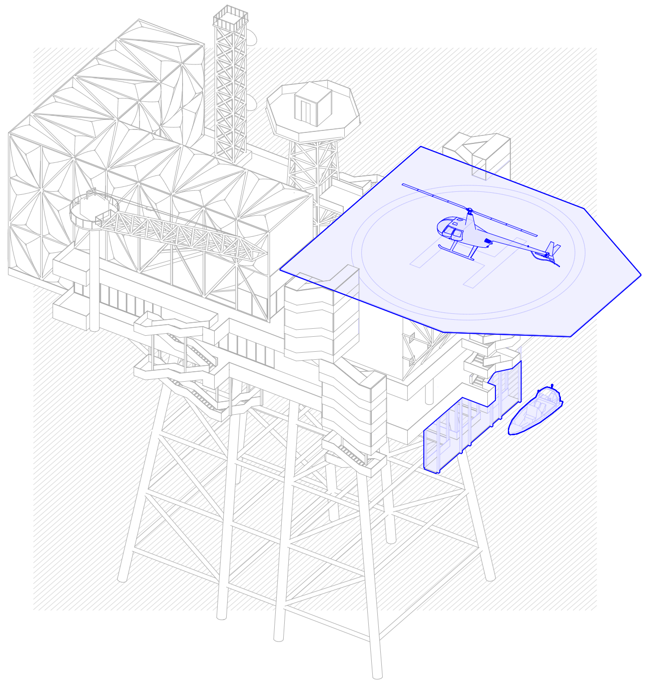
This zone provides researchers with areas for relaxation, social interaction, and a profound connection to the marine environment that surrounds them. Here, the rhythmic ebb and flow of the sea provide a constant reminder of the research center's vital purpose.



5.2 PROGRAM

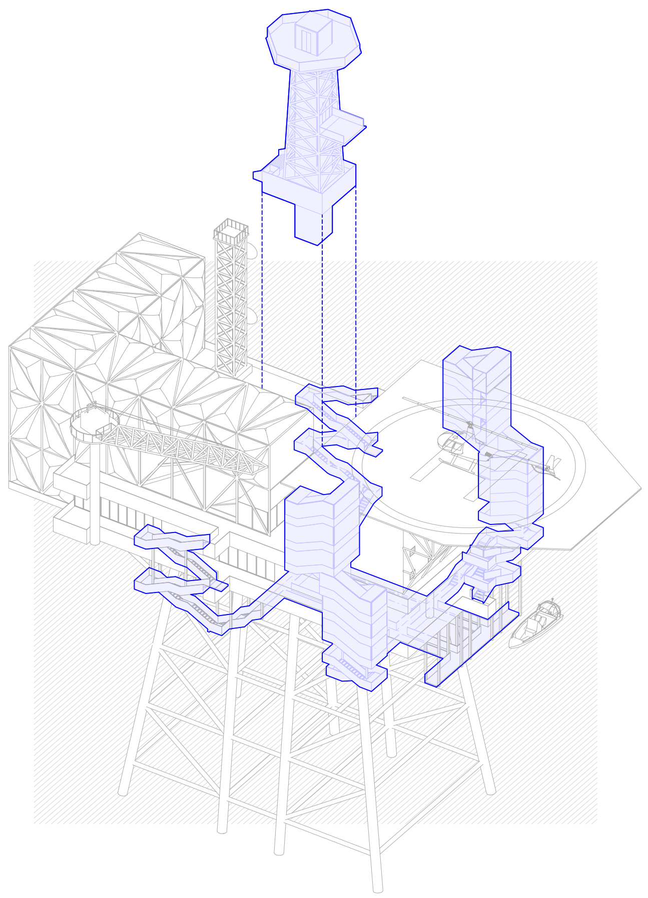
A. TRAVEL ARRANGEMENT OF THE DESTINATION

The offshore research center will utilize both helicopter and boat transportation to ensure accessibility for research personnel. A dedicated helipad on the platform will accommodate helicopter transport, while a small pier will allow access for smaller boats. A contract with a reputable helicopter transportation company will provide regular flights to and from a mainland base. Additionally, boat transport will be coordinated, utilizing vessels suitable for the platform's small pier and prevailing sea conditions. Passengers will receive comprehensive safety briefings before each journey, whether by air or sea. Cargo transport for equipment and supplies will be managed efficiently, ensuring secure handling for both helicopter and boat deliveries. In case of emergencies, robust communication systems and backup transportation options will be in place. This multi-modal transportation strategy ensures flexibility and resilience for reaching this remote research hub in the Adriatic Sea.



B. COMMUNICATIONS

The existing communication modules on the platform were designed and positioned according to oil platform construction standards. However, to provide a safe and comfortable environment for researchers and staff, all existing stairways needed to be replaced and enclosed to ensure accessibility and protection from harsh weather conditions. These communication modules were originally connected by a small pier located beneath the platform, which also served as a diving platform. Due to constant exposure to seawater spray and the potential for deterioration, this pier has also been replaced with a new, more durable structure.
Furthermore, the platform's former derrick has been repurposed into a freight elevator. This ingenious adaptation connects the helipad to the two main levels of the platform, facilitating the efficient transport of equipment, materials, and personnel.



C. CAPACITY

The research center is designed to accommodate a maximum of 42 people, including 30-33 researchers, support staff (technicians, a medical professional, a cook, etc.), and visiting students. This diverse community will have access to state-of-the-art labs, collaborative workspaces, and comfortable living quarters. Research programs are flexible, accommodating stays from 2 weeks to 3 months, fostering both short-term studies and longer-term investigations.

D. EVACUATION

Evacuation plan for an offshore research center

Drawing on existing oil rig regulations and incorporating additional measures, this plan prioritizes a multi-faceted approach, utilizing lifeboats and helicopter evacuation strategies.

1. Evacuation Scenarios
The plan will address a range of potential emergencies:

- **Fire:** A rapid and coordinated evacuation, likely utilizing both lifeboats and helicopter support, depending on the severity and location of the fire.
- **Severe Weather:** In cases of hurricanes or extreme storms, a preventive evacuation may be necessary, utilizing lifeboats or a helicopter, depending on the severity of the approaching weather system.
- **Medical Emergency:** For serious medical emergencies requiring rapid transport to mainland facilities, helicopter evacuation will be the primary method.
- **Structural Damage:** Depending on the extent and nature of the damage, a partial or full evacuation may be required, utilizing a combination of lifeboats and helicopter support.

2. Evacuation Procedures

- **Alarm and Communication Systems:** A clear and reliable alarm system will alert personnel to the need for evacuation. Multiple communication channels (e.g., PA system, radios, satellite phones) will be used to provide instructions and updates.
- **Muster Stations:** Designated muster stations will be strategically located on the platform for personnel to gather.
- **Lifeboat Deployment:** Lifeboats, with a capacity(72 people) exceeding the platform's maximum occupancy (42 people), will be regularly inspected and maintained. Personnel will be trained in lifeboat deployment and safety procedures.
- **Helicopter Landing Zone:** A clearly marked helipad will be designated on the platform, ensuring safe landing and takeoff for helicopter evacuations.

3. Roles and Responsibilities

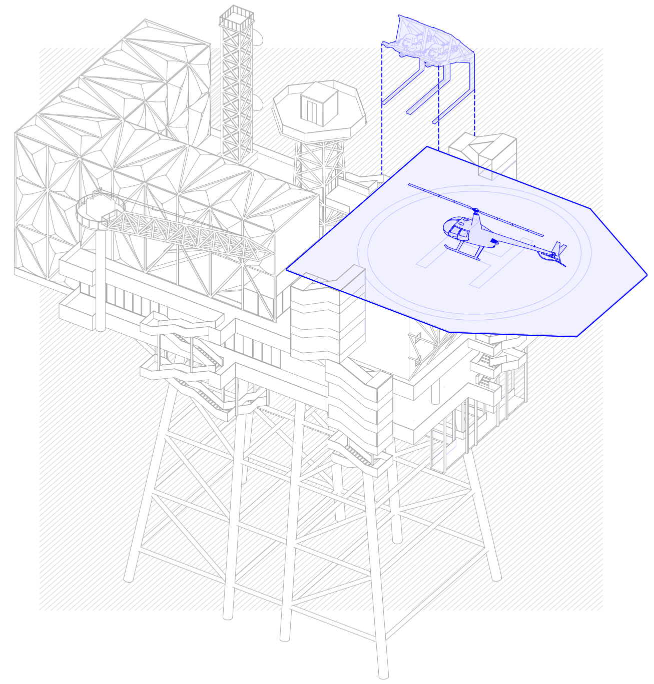
- **Evacuation Coordinator**: A designated individual will oversee the evacuation process, ensuring clear communication, coordination with rescue services, and adherence to safety protocols.

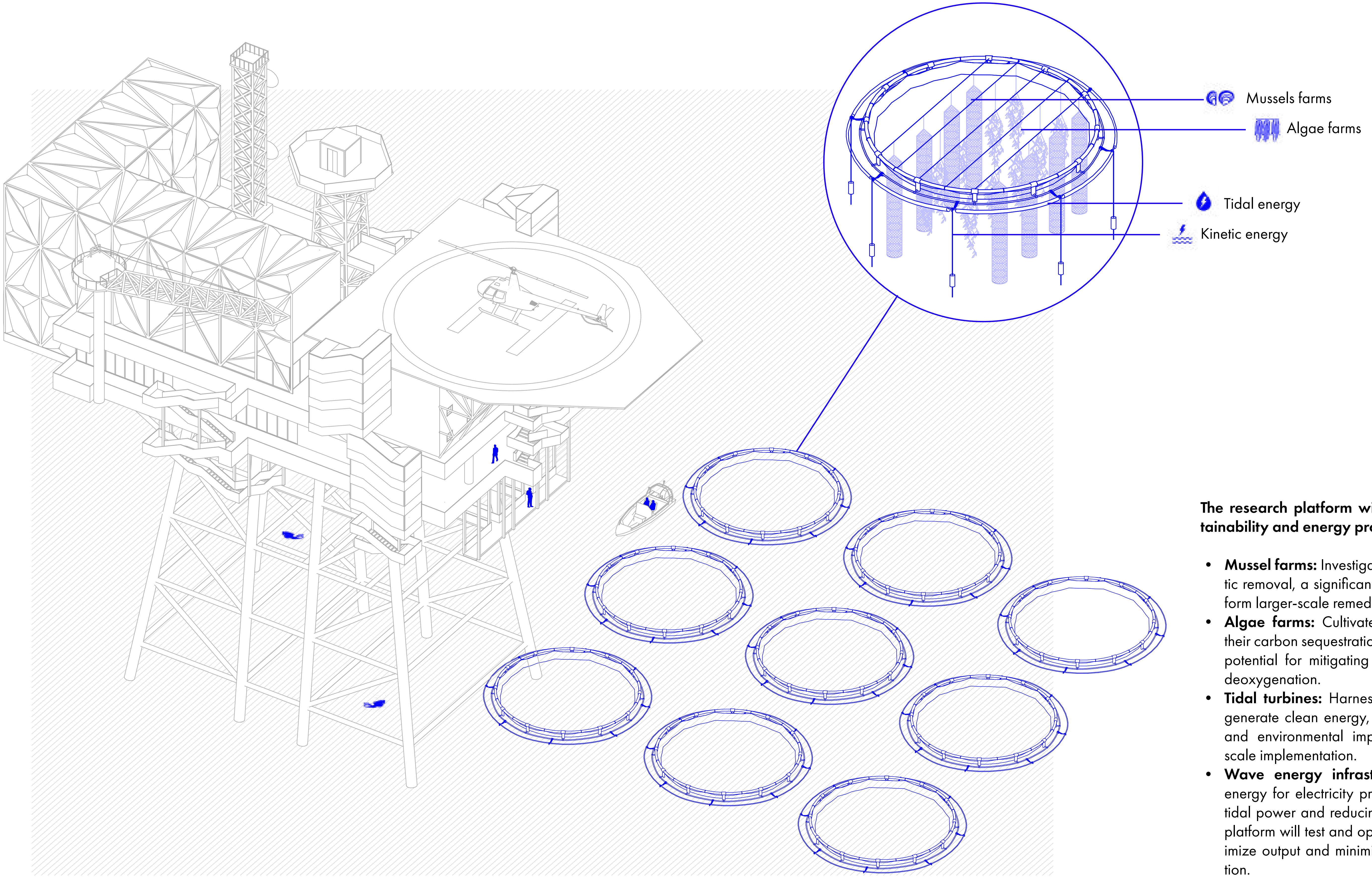
4. Training and Drills

- **Regular Drills:** Frequent evacuation drills will be conducted to familiarize personnel with evacuation procedures, ensure the smooth operation of lifeboats and the helipad, and identify any potential issues in the evacuation plan.
- Safety Training: All personnel on the platform will receive comprehensive training in emergency procedures, first aid, lifeboat safety, and helicopter evacuation protocols.

5. Additional Considerations

- **Weather Monitoring:** Continuous monitoring of weather conditions will be crucial to make informed decisions about preemptive evacuations.
- **Communication Equipment:** Redundant communication systems will be in place to ensure reliable contact with external agencies in case of emergencies.

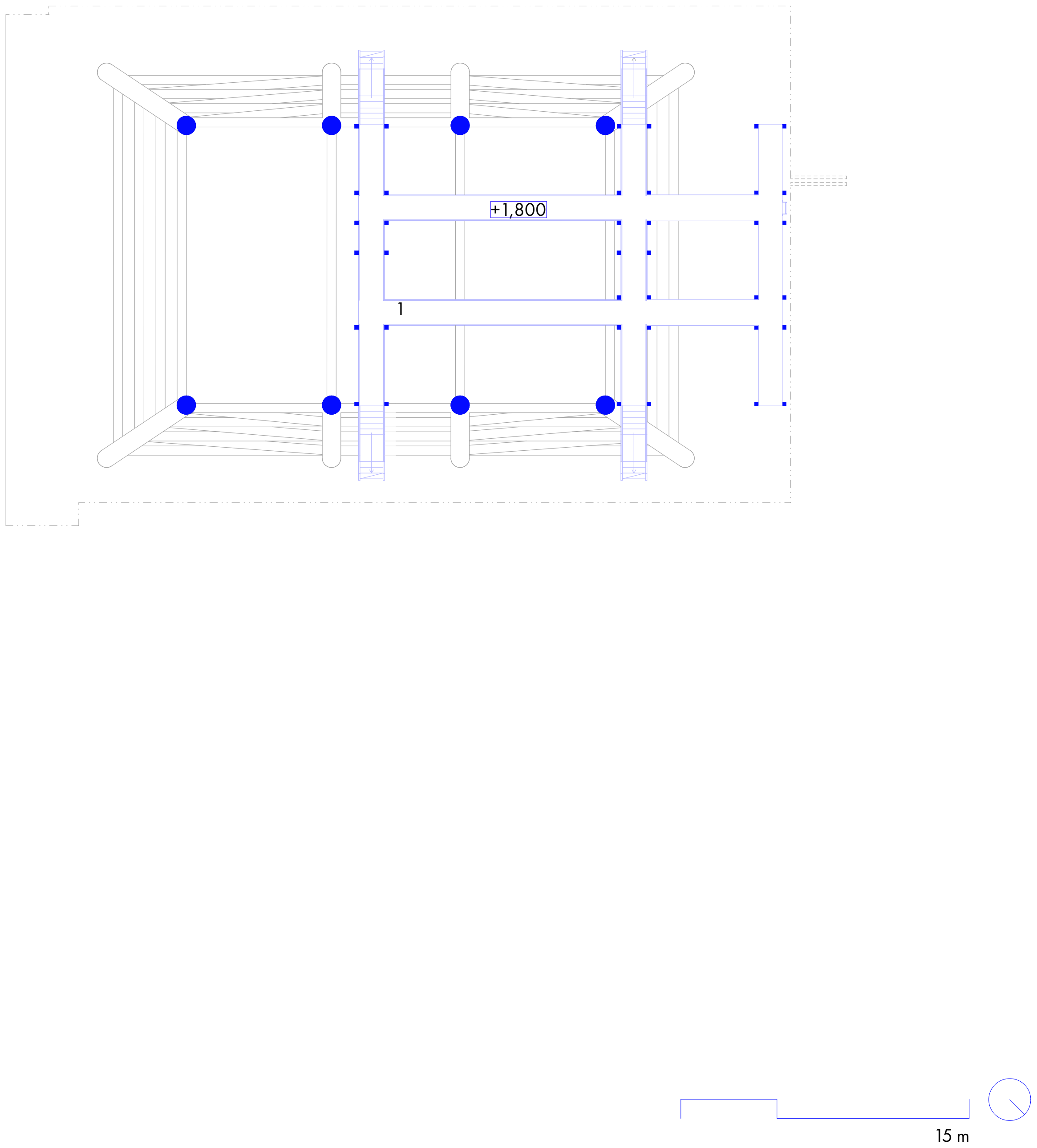




The research platform will address marine sustainability and energy production through

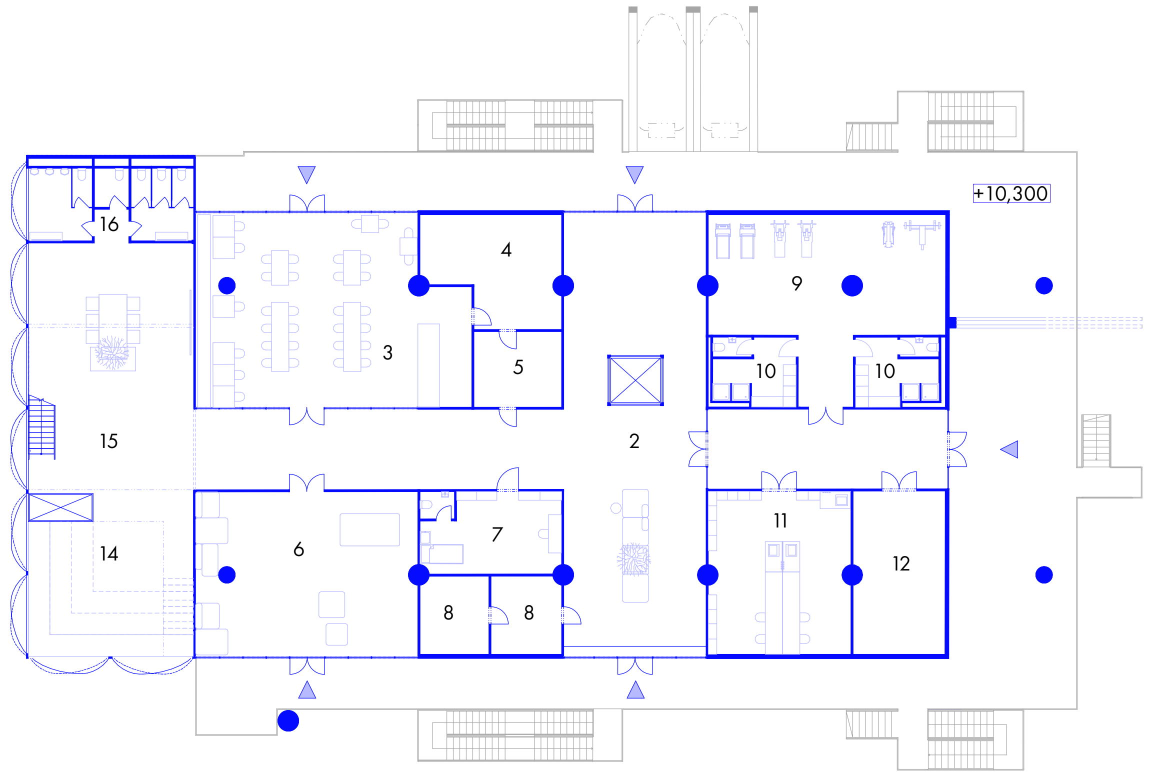
- **Mussel farms:** Investigate their use for microplastic removal, a significant issue near Venice, to inform larger-scale remediation efforts.
- **Algae farms:** Cultivate diverse algae to study their carbon sequestration and oxygen production potential for mitigating ocean acidification and deoxygenation.
- **Tidal turbines:** Harness underwater currents to generate clean energy, assessing their efficiency and environmental impact for potential large-scale implementation.
- **Wave energy infrastructure:** Capture wave energy for electricity production, complementing tidal power and reducing fossil fuel reliance. The platform will test and optimize converters to maximize output and minimize environmental disruption.

FLOOR N. -2



1. Diving platform

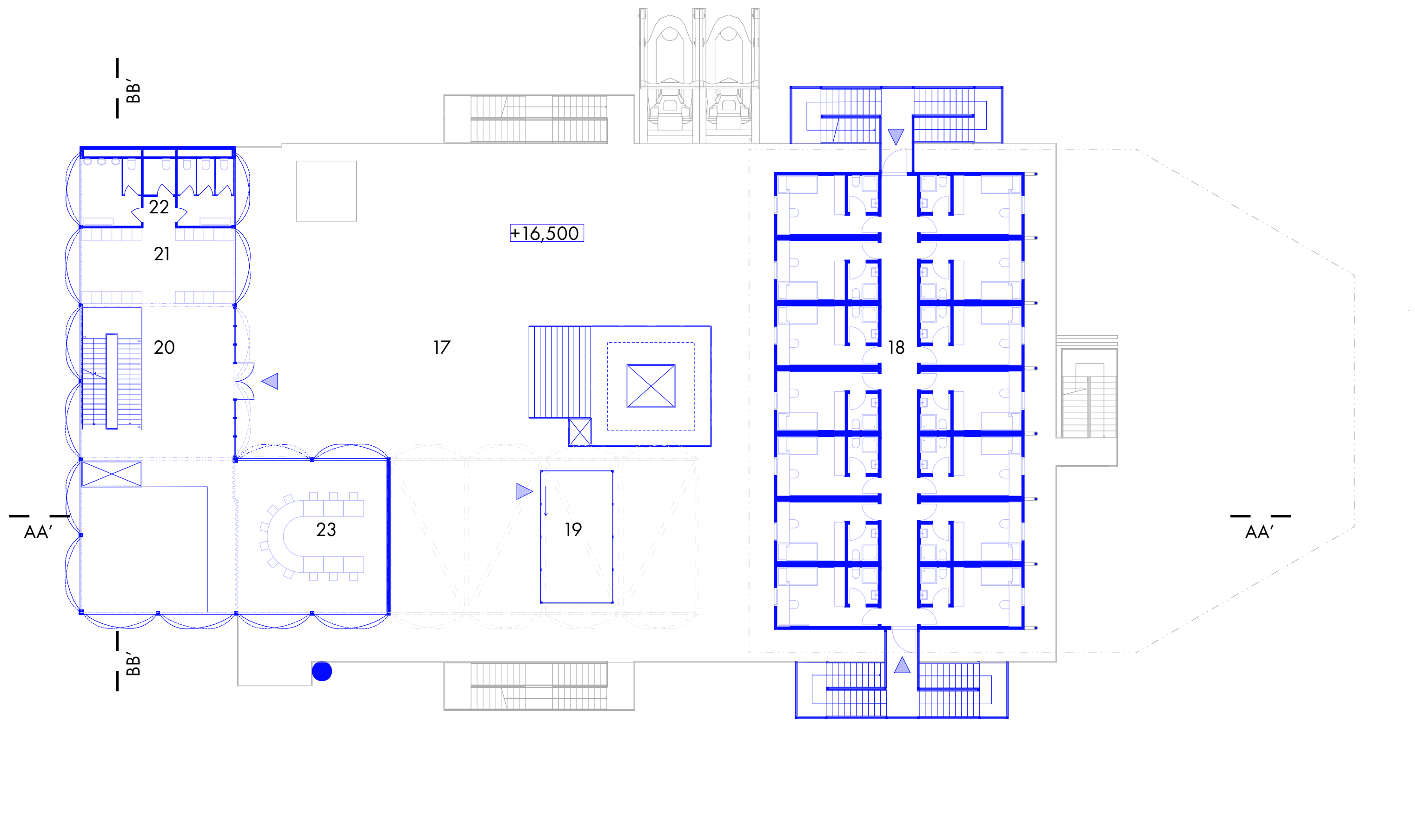
FLOOR N. -1

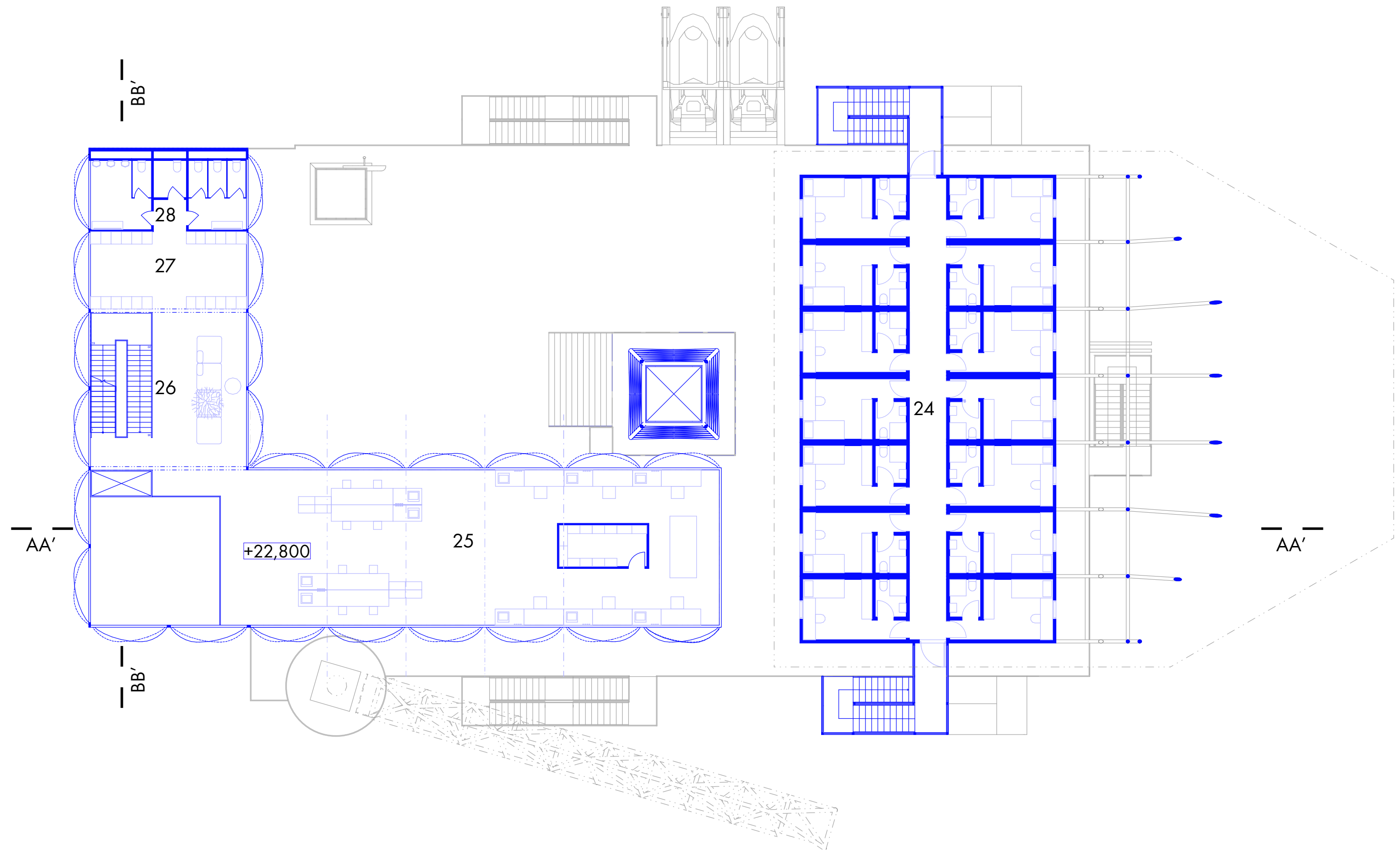


Floor n. -2
2. Hall
3. Dining room
4. Kitchen
5. Food storage
6. Lounge
7. Medical facilities
8. Technical room
9. Gym
10. Cloak room
11. Laboratory
12. Storage
13.Topside
14. Atrium
15. Gallery
16. WC

FLOOR N. 0

FLOOR N. 1

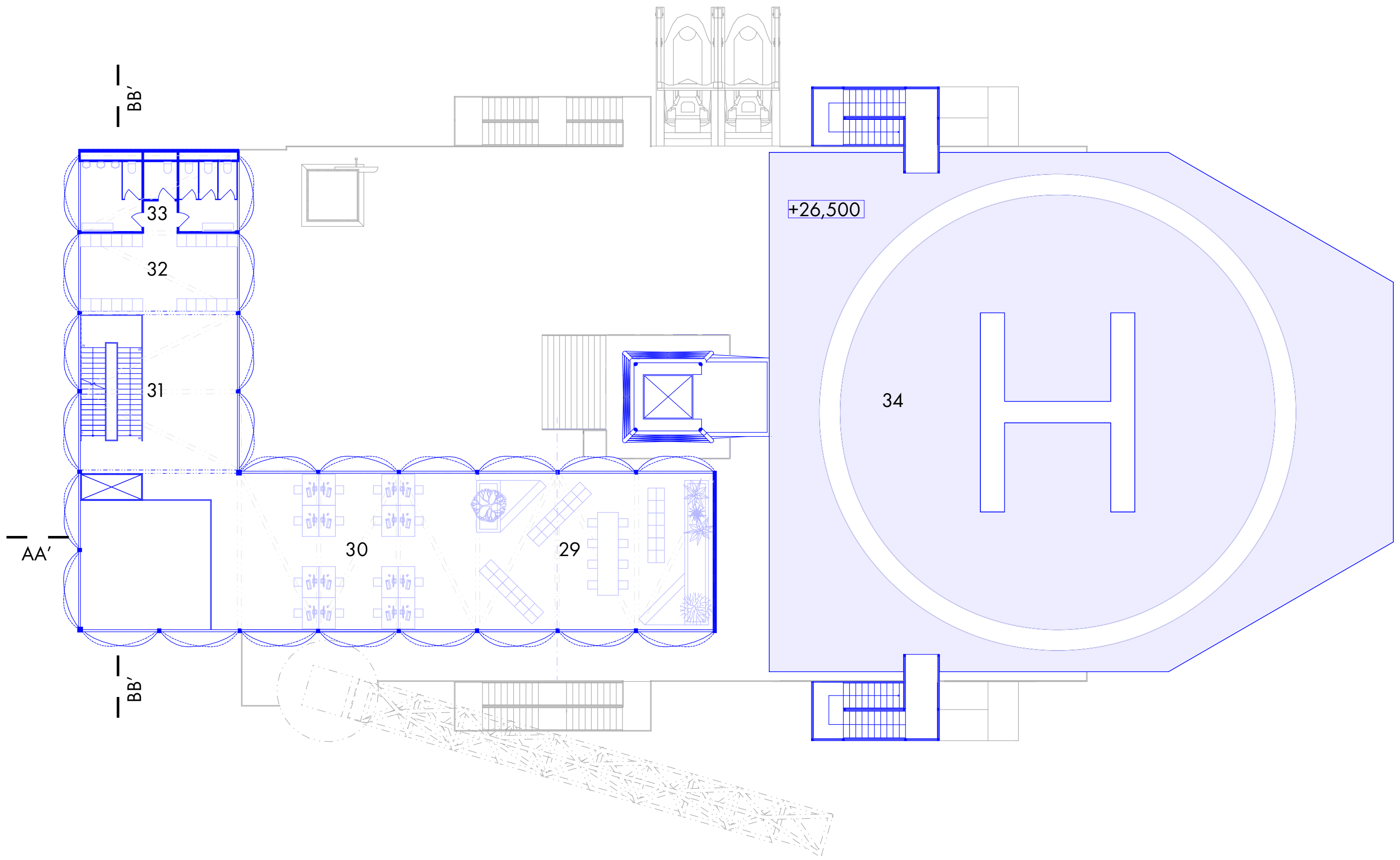


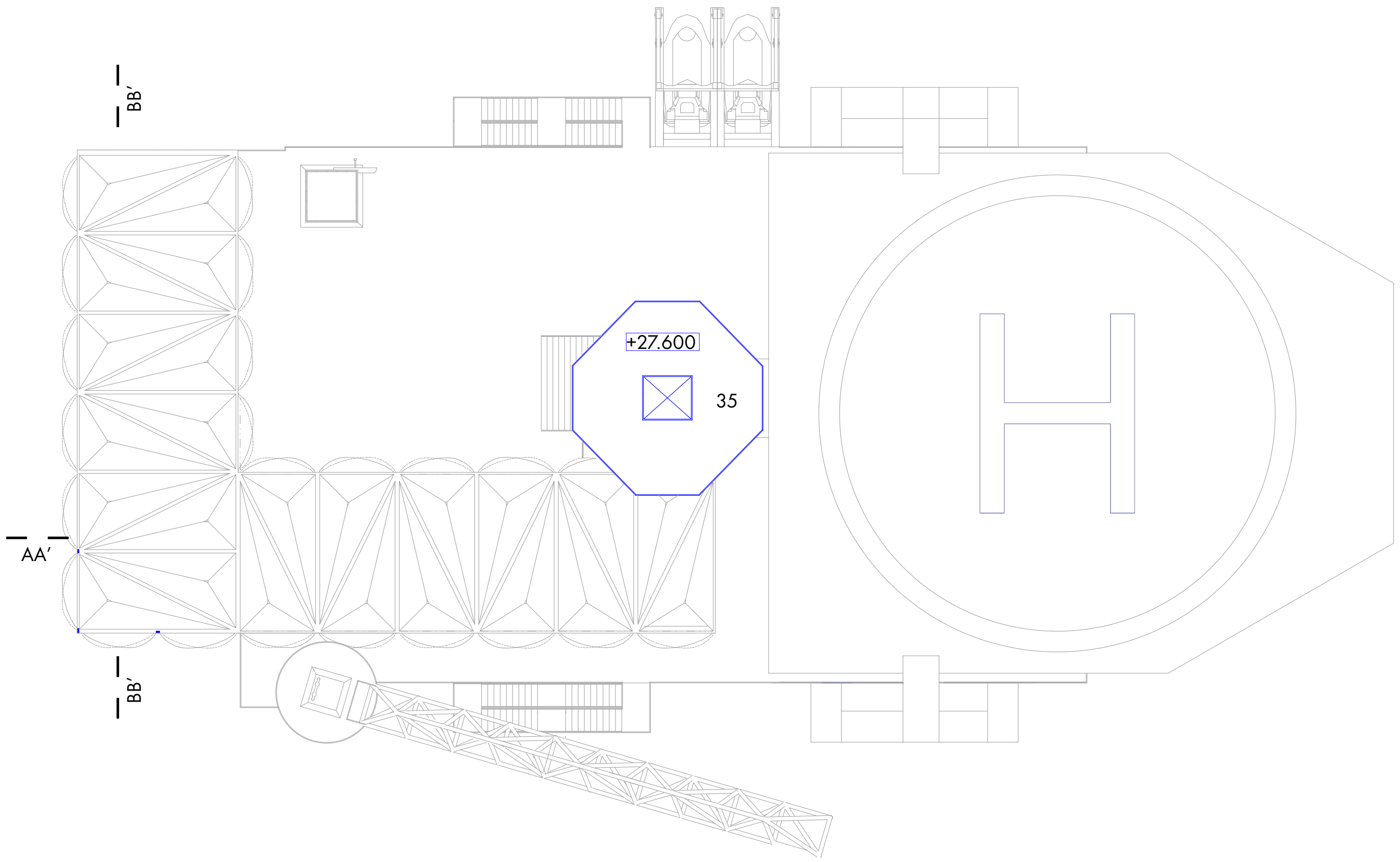


Floor n. 0
17. Topside
18. Personal living quarters
19. Greenhouse
20. Hall
21. Cloak room
22. WC
23. Meeting room

Floor n. 1
24. Personal living quarters
25. Laboratories
26. Hall
27. Cloak room
28. WC

FLOOR N. 2



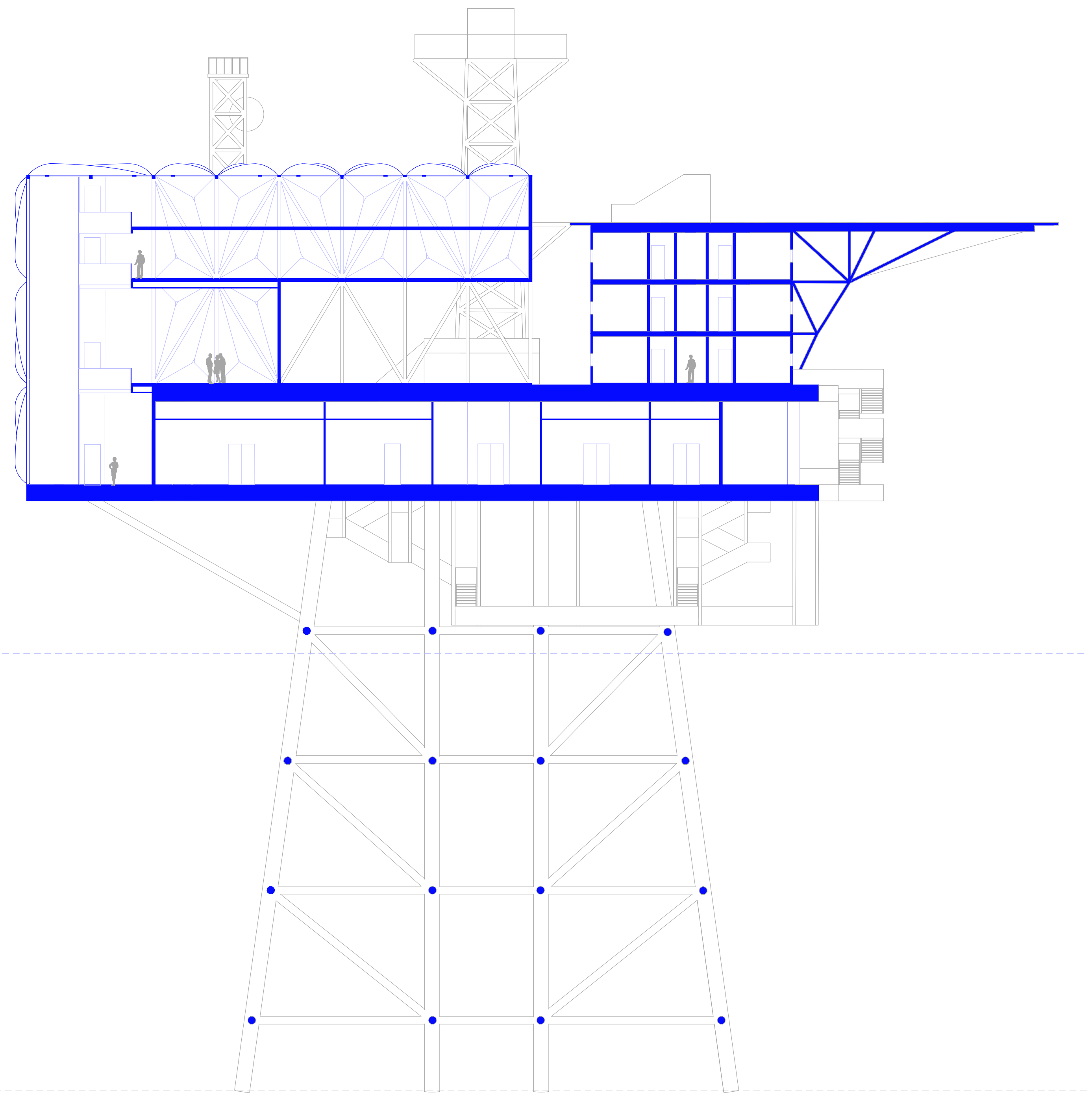


29. Library
30. Laboratory
31. Hall
32. Cloak room
33. WC
34. Helipad

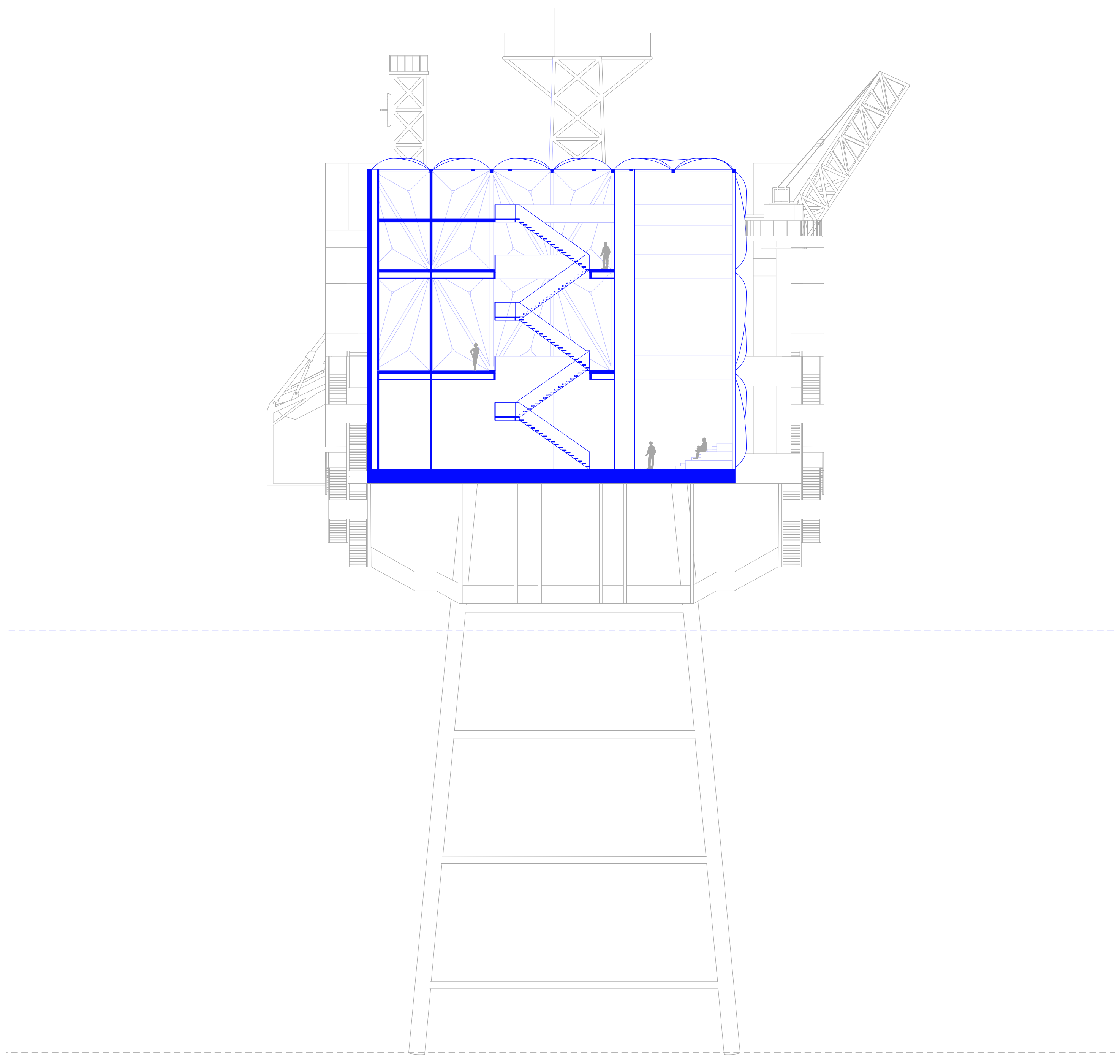
15 m

35. Observatory

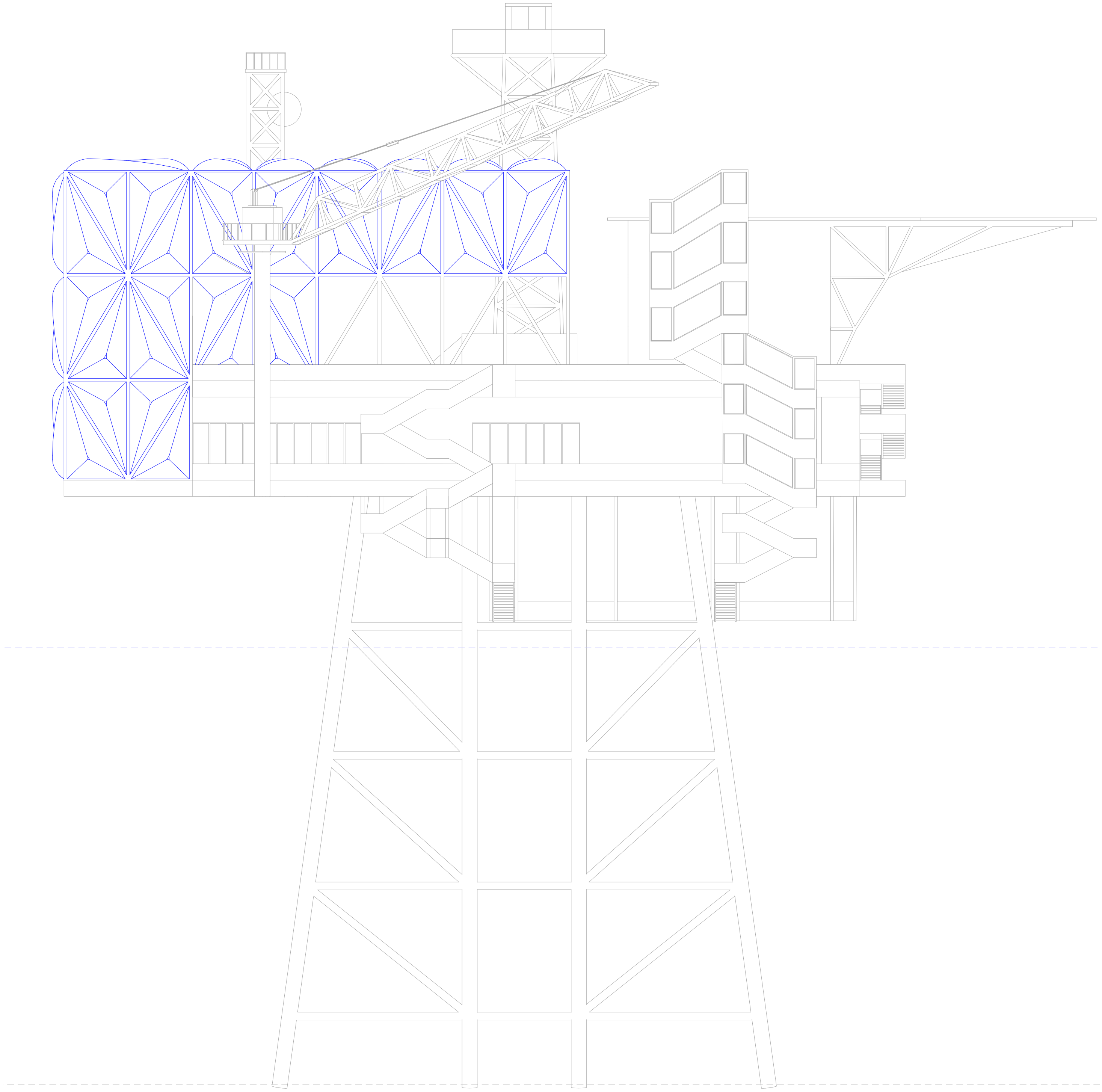
SECTION AA’



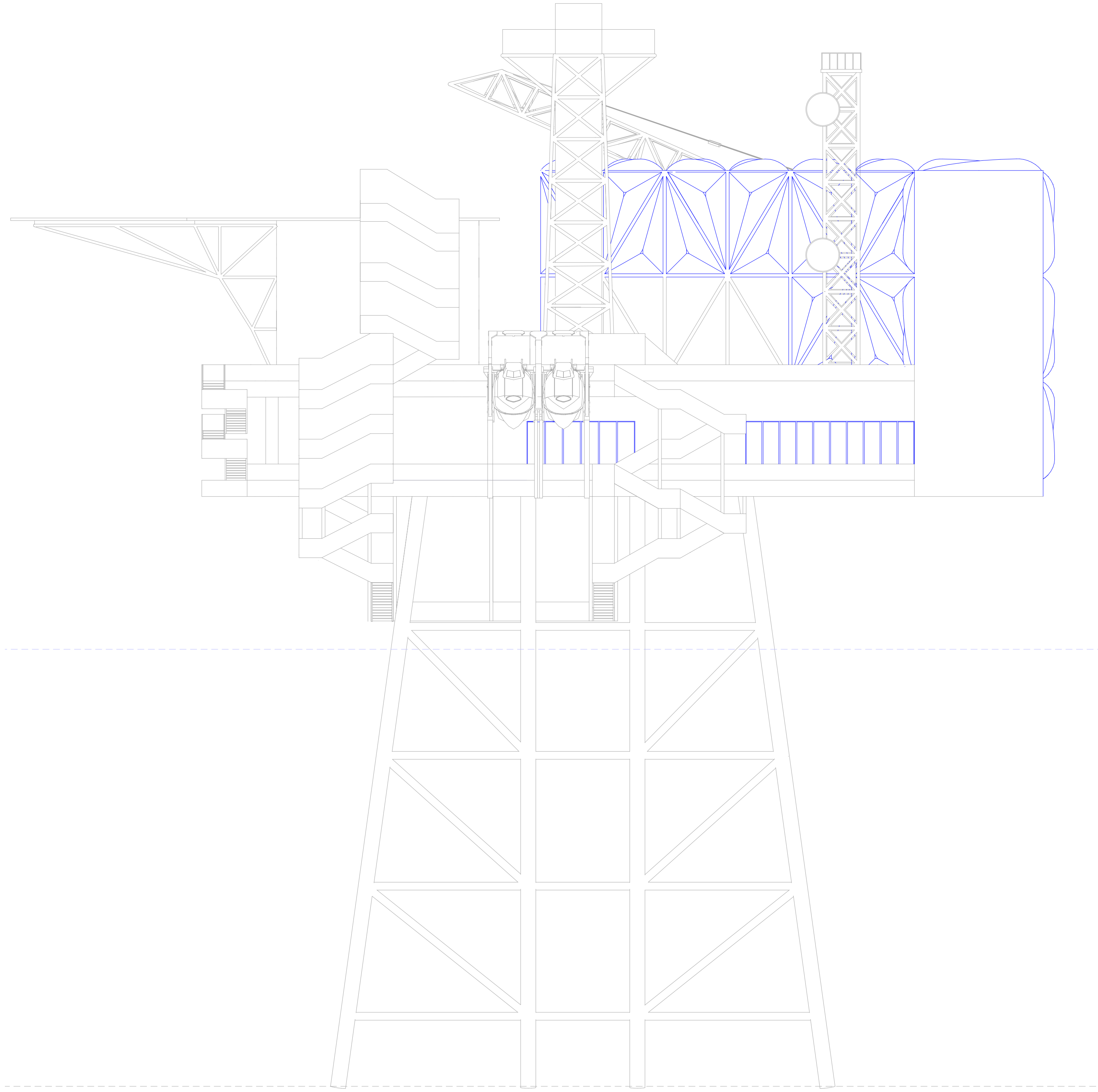
SECTION BB’



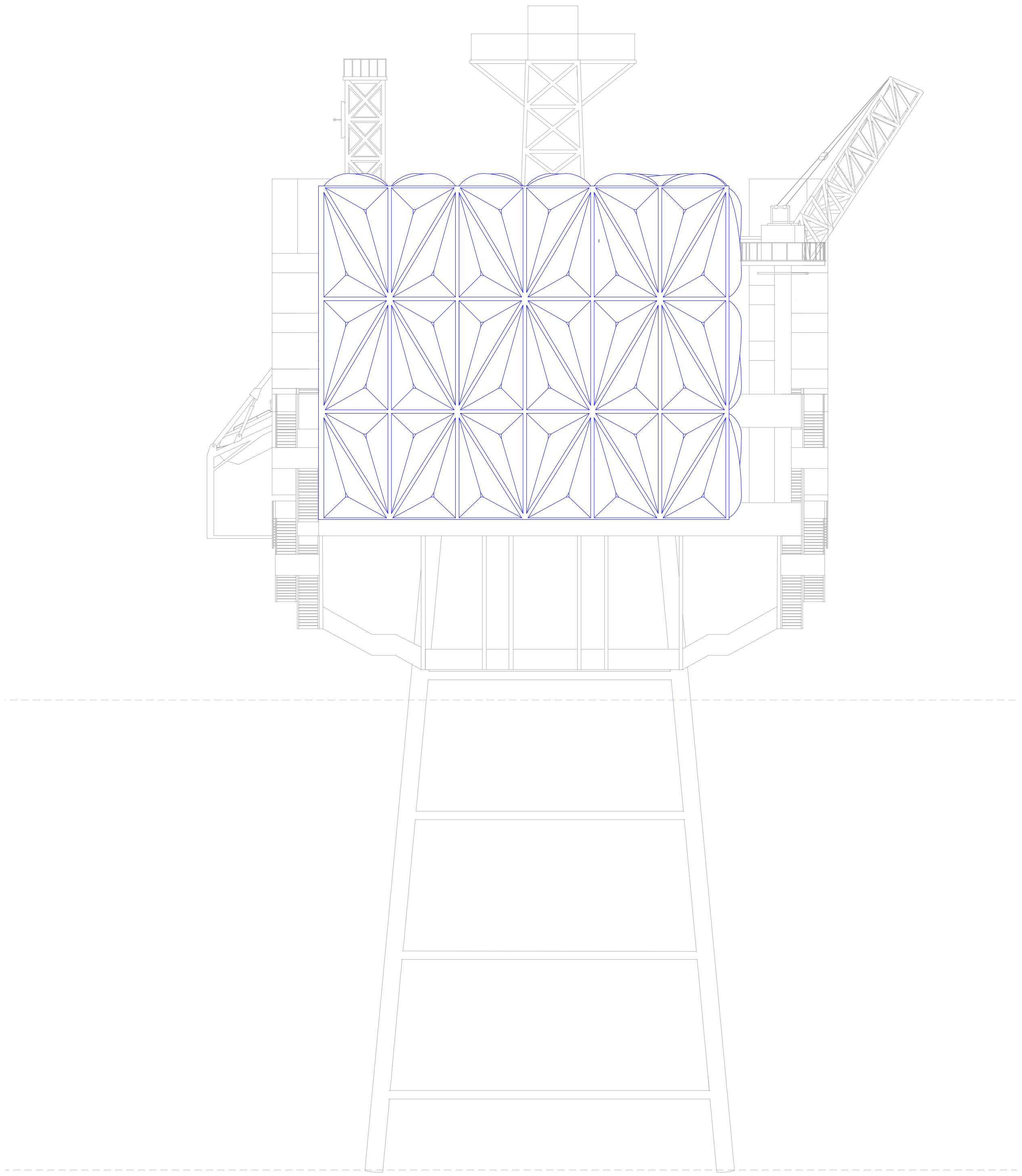
NORTHEAST VIEW



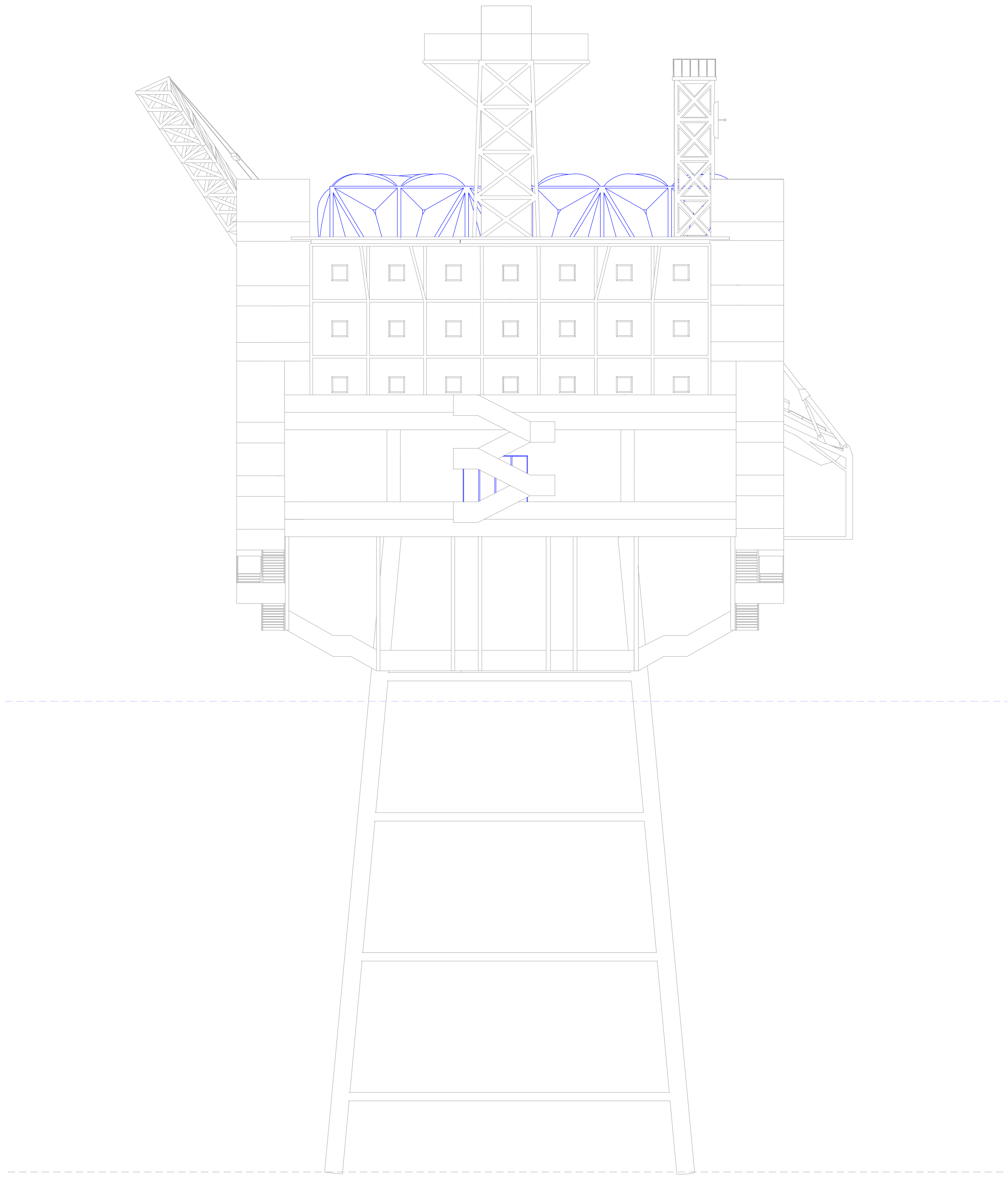
SOUTHEAST VIEW



SOUTHWESTERN VIEW



NORTHWESTERN VIEW



05

TECHNICAL PART

7.1 PLATFORM STRUCTURE

Oil rig platforms are essential structures in the offshore oil and gas industry, serving as artificial islands from which exploration, drilling, and production operations are conducted. These platforms are like floating workplaces for crews, with everything they need to drill, pump, and live out at sea.

Types of offshore platforms:
The type of platform used depends on factors like water depth, seabed conditions, and the scale of operations. The main categories include:

- **Fixed Platforms:** These are permanently attached to the seabed, offering the most stable foundation for long-term operations.
- **Compliant Towers:** These slender structures are designed to flex and move with the waves, suitable for deeper waters than fixed platforms.
- **Floating Platforms:** Anchored to the seabed or dynamically positioned, these platforms provide flexibility in deeper waters, but are more susceptible to movement.
- **Spar Platforms:** These cylindrical platforms are partially submerged and anchored to the seabed, offering stability in deep water.

The project utilizes a fixed platform that is the most common type in shallower waters, where the seabed provides a solid base for construction. They are typically constructed of steel or concrete and consist of a supporting structure (jacket) that extends from the seabed to above the waterline. A deck atop the jacket provides space for drilling equipment, living quarters, and other facilities.

Structures on Fixed Platforms:

- **Drilling Rig:** The central element of the platform, used to bore wells into the seabed to extract oil and gas.
- **Production Facilities:** Equipment for separating oil, gas, and water, as well as storage tanks and pipelines.
- **Living Quarters:** Accommodations for the crew, including bedrooms, kitchens, recreational areas, and medical facilities.
- **Helipad:** For transporting personnel and supplies to and from the platform.
- **Crane:** Used for lifting and moving heavy equipment and materials.
- **Safety systems:** Essential for emergency situations, including lifeboats, fire suppression systems, and communication equipment.

While this project envisions the transformation of an existing fixed oil platform into a cutting-edge research center, the specific structural condition of the platform is unknown. It is assumed that a thorough structural assessment would be conducted by qualified engineers before any repurposing begins.

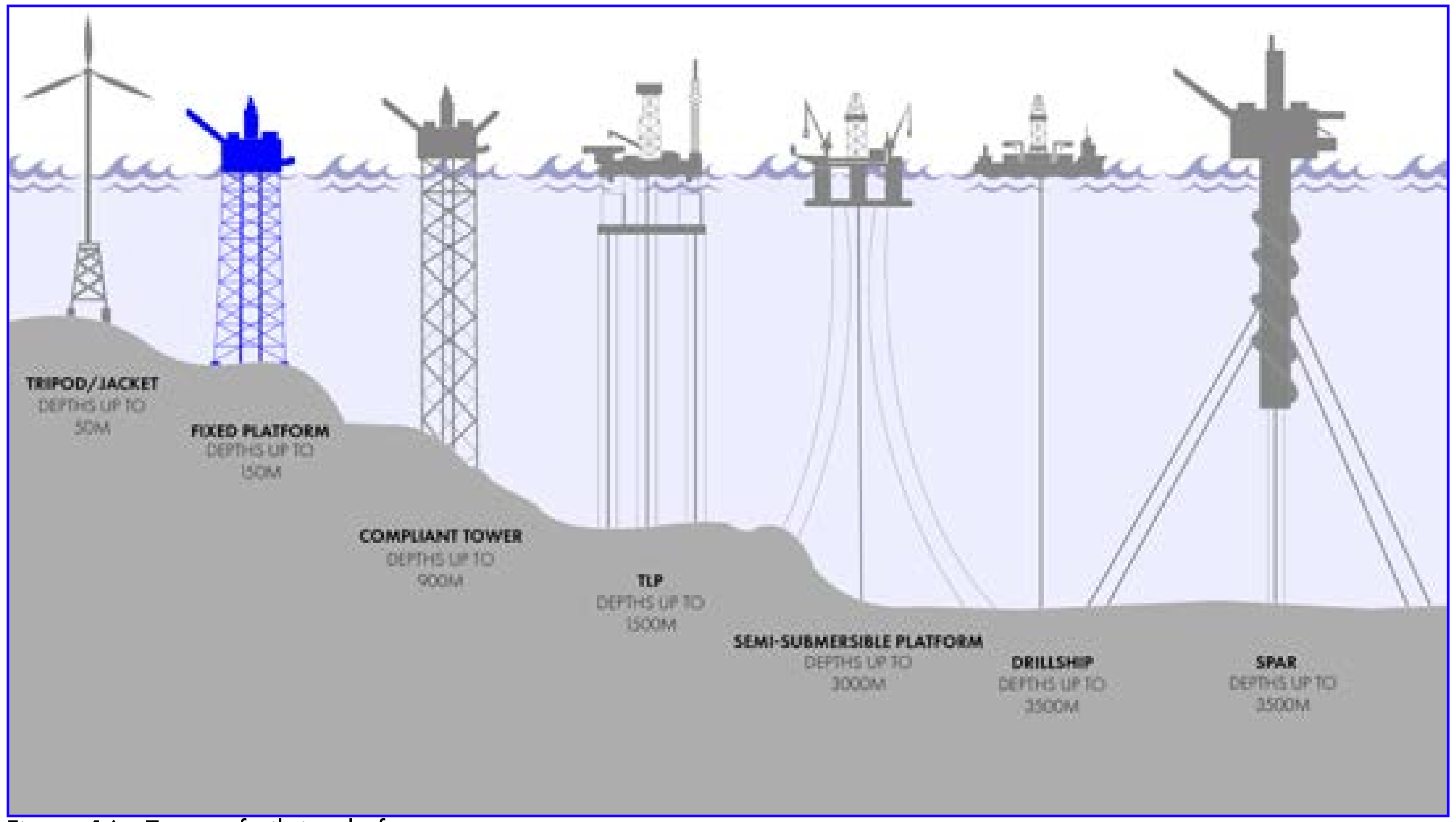


Figure 16 - Types of oil rig platforms.

Preventive measures and enhancements
To ensure the stability and longevity of the repurposed platform, several preventive measures and structural enhancements would be essential. It is crucial to perform a structural survey and analysis, including

Inspecting: Examining all structural elements for signs of corrosion, fatigue, or damage.
Testing: Conducting load tests and material analysis to assess the platform's current strength and capacity.
Modeling: Creating computer simulations to asses the platform's behavior under various environmental conditions (wind, waves, currents).

Monitoring and maintenance
- **Sensors and monitoring systems:** Installing sensors to monitor structural stress, vibration, and corrosion rates will provide early warning signs of potential issues.
- **Regular inspections:** Conducting routine inspections and maintenance will help identify and address any developing problems before they become major threats to stability.

7.2 MATERIAL SOLUTION

A. Pneumatic structures: reimagining architecture for an offshore research center

Pneumatic structures, characterized by their lightweight, membrane-like envelopes inflated with air, offer a uniquearchitectural approach with distinct advantages and considerations, particularly in challenging environments like an offshore setting.

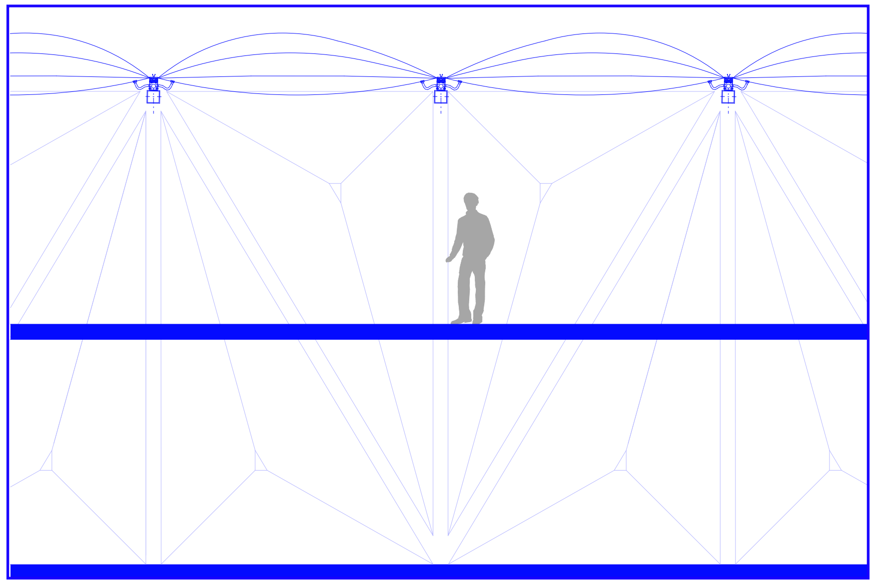
Advantages in a marine environment
- **Lightweight construction:** The minimal material requirements of pneumatic structures reduce the load on the existing oil platform foundation, offering a significant advantage in offshore construction.
- **Adaptability to harsh conditions:** The flexible nature of pneumatic membranes allows them to withstand wind loads and movement associated with waves, making them well-suited for marine environments.
- **Corrosion resistance:** ETFE material (ethylene tetrafluoroethylene) is highly resistant to saltwater and UV degradation, ensures the longevity of the structure.
- **Natural light transmission:** Translucent pneumatic membranes can create bright and airy interiors, maximizing natural light penetration while reducing reliance on artificial lighting.
- **Potential for energy efficiency:** The enclosed air volume within a pneumatic structure can be manipulated for passive heating and cooling, reducing energy consumption.

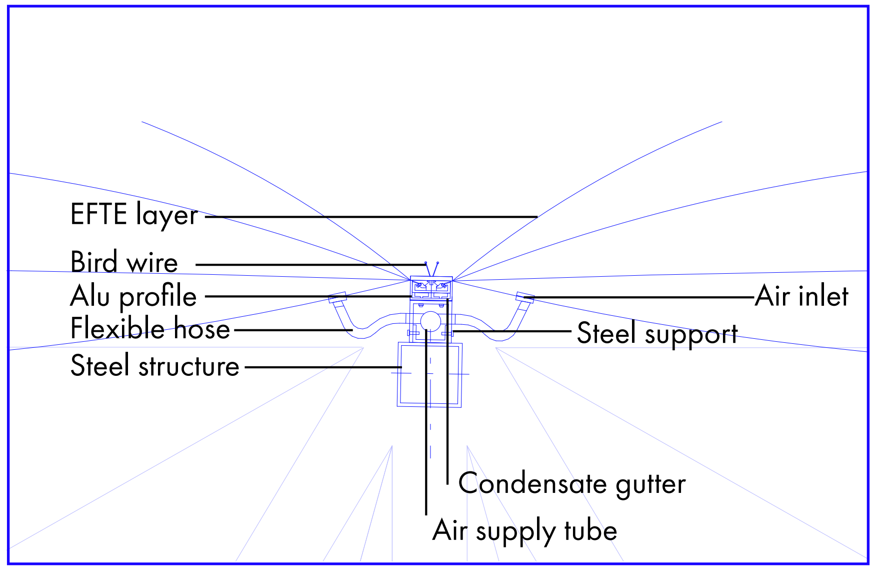
Challenges in a marine environment
- **Maintenance:** Regular inspection and maintenance are crucial to ensure the integrity of the membrane and air pressure systems, particularly in harsh offshore conditions.
- **Potential for punctures:** Sharp objects, debris, or bird strikes could damage the membrane, necessitating repair.
- **Temperature fluctuations:** Extreme temperatures can impact air pressure within the structure, requiring careful monitoring and adjustment.
- **Long-term durability:** While ETFE is durable, prolonged exposure to saltwater and UV radiation can eventually lead to degradation. Careful material selection and maintenance are vital.

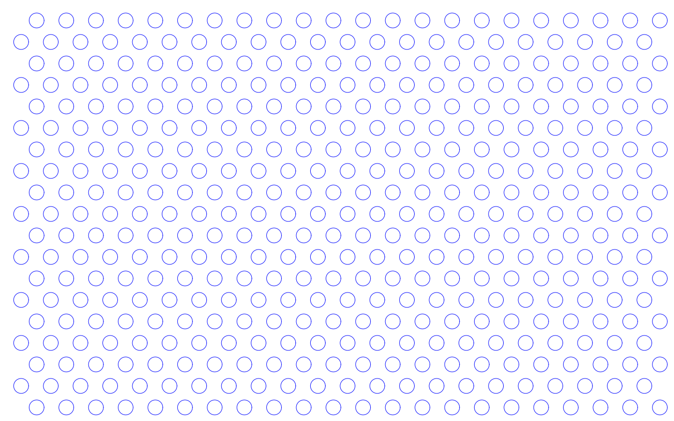
Case study: Khan Shatyr entertainment center by Norman Foster
The Khan Shatyr Entertainment Center in Astana, Kazakhstan, designed by renowned architect Norman Foster, provides a compelling example of a large-scale pneumatic structure. Its ETFE-clad, tent-like form encloses a vast public space, showcasing the potential of this technology for creating unique architectural experiences.

While not an offshore structure, the Khan Shatyr demonstrates several principles relevant to this project:
- **Lightweight and spacious:** The pneumatic design allows for a large, column-free interior space, maximizing flexibility and visual impact.
- **Climate control:** The ETFE membrane provides solar control and thermal insulation, creating a comfortable internal climate despite extreme temperature variations in Astana.

Figure 17 - Khan Shatyr in Astana, Kazakhstan [28].







The EFTE foil is covered with a PV pattern

The National Aquatics Center in Beijing, China, serves as a prime example of innovative pneumatic structure design. Completed for the 2008 Summer Olympics, its iconic exterior comprises thousands of ETFE bubbles, forming a captivating and seemingly random pattern. However, this structure is not merely aesthetic; it is a marvel of engineering.

The Water Cube's pneumatic structure provides numerous advantages. The ETFE bubbles allow for natural light diffusion, reducing the need for artificial lighting and creating a visually stunning interior. The material's lightweight nature significantly reduces the structural load. Moreover, ETFE is a durable and weather-resistant material, ensuring the longevity of the structure. The Water Cube stands as a testament to the potential of pneumatic structures in creating iconic, functional, and sustainable architectural landmarks.

B. Sandwich panels: balancing performance and sustainability in an offshore research center

This project employs sandwich panels as a key element in the construction of the offshore research center, prioritizing both performance and sustainability in the demanding marine environment. The chosen design utilizes a combination of robust materials to create a durable, energy-efficient, and comfortable workspace for scientists.

Outer and internal facing: Galvanized steel

The exterior facing of the sandwich panels is constructed from galvanized steel. This material was selected for its exceptional durability, corrosion resistance, and ability to withstand the harsh conditions of the Adriatic Sea. The galvanization process provides a long-lasting protective layer against saltwater and UV radiation, minimizing maintenance requirements.

Core insulation: Rockwool

At the heart of the sandwich panel lies a core of rockwool insulation. This material offers numerous benefits crucial for the research center:

- **Fire resistance:** Rockwool's inherent fire-resistant properties provide a critical safety measure in the isolated offshore setting.
- **Thermal insulation:** The rockwool core effectively regulates indoor temperatures, minimizing energy consumption for heating and cooling while ensuring a comfortable environment for scientific work.
- **Acoustic performance:** Rockwool's excellent sound absorption properties minimize distractions from external noise, promoting focus and concentration within the research center.
- **Sustainability:** Rockwool is often made from recycled materials, aligning with the project's commitment to environmental responsibility.

Integrated Design

The sandwich panel construction effectively integrates these carefully selected materials, creating a synergistic system that optimizes performance. The panels are designed with a thickness of 200mm to achieve a balance of thermal efficiency, structural integrity, and weight considerations.

Benefits for the research center

This sandwich panel approach offers several crucial benefits for the offshore research center.

- **Durability and Resilience:** The panels are designed to withstand the aggressive marine environment, ensuring longevity and minimal maintenance.
- **Energy Efficiency:** The high-performance insulation contributes to low energy consumption for heating and cooling, minimizing the center's ecological footprint.
- **Comfortable and Productive Workspace:** The acoustic insulation and light-reflective inner facing create a peaceful and stimulating environment for scientific research.
- **Sustainable Construction:** The use of recycled materials and durable construction methods contribute to the project's overall sustainability goals.

C. Vacuum glass: a step towards high-performance insulation

How it works:

- **Vacuum chamber:** Two panes of glass are sealed together with a hermetically sealed gap in between, evacuated to create a vacuum.
- **Pillars:** Tiny support pillars, barely visible to the eye, are strategically placed within the vacuum chamber to prevent the panes from collapsing inward due to atmospheric pressure.
- **Airtight seal:** An airtight sealant around the perimeter of the unit prevents air from leaking into the vacuum, maintaining its insulation properties.

Advantages of vacuum glass

- **Exceptional thermal insulation:** Vacuum glass offers significantly better insulation than traditional double- or triple-glazed windows, as the vacuum prevents heat transfer through conduction or convection. This can dramatically reduce energy consumption for heating and cooling.
- **Noise reduction:** The vacuum also acts as a sound barrier, effectively reducing noise transmission, creating a quieter interior environment.
- **Slim profile:** Despite its superior insulation performance, vacuum glass can be manufactured with slim profiles, minimizing the visual impact on the building design.

C. Manni Group lightweight steel

This project embraces a sustainable approach to material selection by prioritizing durability, weight optimization, and proximity to the construction site. The chosen structural design utilizes a combination of lightweight steel framing from the Italian manufacturer Manni Group for the sandwich panels [29].

Selecting Manni Group, located in Italy, as the supplier for the lightweight steel framing contributes to the project's overall sustainability goals. Sourcing materials from a company situated in Italy near to Adriatic coastline significantly reduces transportation distances and associated carbon emissions compared to using steel from more distant manufacturers. This conscious decision aligns with the project's commitment to minimizing its environmental footprint.

The innovative lightweight steel framing systems offer a compelling solution for the sandwich panels, providing

- **Weight optimization:** Their optimized steel profiles and framing systems significantly reduce the overall weight of the panels, minimizing the load on the repurposed oil platform foundation. This is particularly crucial in an offshore environment where structural efficiency is paramount.
- **Strength and durability:** Despite their lightweight nature, Manni Group's steel products are engineered for exceptional strength, ensuring the panels can withstand the demanding wind and wave forces encountered in the Adriatic Sea.
- **Design flexibility:** Manni Group offers a diverse range of steel profiles and connection systems, allowing for design flexibility in tailoring the sandwich panels to meet the specific structural and aesthetic needs of the research center.
- **Prefabrication efficiency:** Their systems are often designed for prefabrication, which streamlines the construction process, improves accuracy, and reduces on-site labor, further contributing to sustainability by minimizing waste and construction time.

D. Fiber-reinforced polymers: a lightweight and durable solution

Fiber-reinforced polymers (FRP) have been selected as the primary structural material for their exceptional strength-to-weight ratio, inherent corrosion resistance, and design flexibility.

FRP: A Material Tailored for Marine Environments

FRP composites, made by combining strong fibers with a polymer matrix, offer a compelling blend of properties that make them ideal for this offshore setting:

- **Lightweight construction:** FRPs are significantly lighter than traditional construction materials like steel, minimizing the load on the existing platform foundation. This is crucial for ensuring the stability and longevity of the repurposed structure in a marine environment.
- **Exceptional strength:** Despite their lightweight nature, FRPs possess remarkable strength, often exceeding that of steel. This allows for the creation of robust structural elements capable of withstanding the demanding wind and wave loads encountered in the Adriatic Sea.
- **Corrosion resistance:** FRPs are inherently resistant to the corrosive effects of saltwater, humidity, and marine organisms. This inherent durability translates to lower maintenance requirements and a longer lifespan for the research center, reducing the need for costly and resource-intensive repairs or replacements.

Types of FRP

The project will utilize a combination of glass fiber reinforced polymers (GFRP) and carbon fiber reinforced polymers (CFRP), chosen for their specific properties and cost-effectiveness:

- **GFRP:** GFRP will be the primary FRP material used for the majority of structural elements due to its good balance of strength, durability, and affordability.
- **CFRP:** CFRP, known for its exceptional strength and stiffness, will be strategically incorporated in areas requiring maximum structural performance, such as critical load-bearing points or sections exposed to the highest stresses.

Sustainable choice

The use of FRPs aligns with the project's commitment to sustainability. Their lightweight nature reduces transportation emissions and the need for heavy construction equipment. Their inherent durability and corrosion resistance minimize the need for maintenance and replacement, further reducing the environmental impact of the research center over its lifespan.

Addressing Challenges

While FRPs offer numerous advantages, certain considerations are essential for successful implementation:

- **UV resistance:** UV-resistant formulations or protective coatings will be incorporated to ensure long-term durability under prolonged exposure to sunlight.
- **Fire resistance:** Fire-retardant additives or coatings will be applied to meet building codes and ensure the safety.
- **Specialized expertise:** The project will engage experienced fabricators and engineers specializing in FRP design and construction to ensure the highest standards of quality and structural integrity.

06
SUSTAINABILITY

8.1 ENERGY

A multi-faceted energy strategy for an offshore research center
Reimagining an oil platform into a marine research center presents a unique opportunity to create a truly self-sufficient and sustainable hub powered by the very forces surrounding it. By integrating solar, tidal, and kinetic energy, this transformed platform becomes a model for harnessing the ocean's full potential.

Solar power
- **Transparent PV modules:** Integrated into the ETFE building envelope, these modules passively generate electricity while allowing natural light to permeate the interior, reducing the need for artificial lighting.
- **Solar pavers:** Durable and walkable, solar pavers cover the platform's large open area, converting sunlight into energy and creating a visually appealing and functional outdoor space.

Embracing the tides
- **Tidal energy generation:** The Adriatic Sea's predictable tides offer a consistent source of renewable energy. Underwater turbines, strategically placed near the platform, capture the kinetic energy of moving water to generate electricity.

Kinetic Energy
- **Wave energy converters:** Innovative devices capture the up-and-down motion of waves to generate power. These converters can be integrated into the platform's structure or deployed nearby, contributing to the overall energy mix.

Dynamic energy ecosystem
- **Smart grid integration:** All energy sources are interconnected through a smart grid system, enabling real-time monitoring of energy production and consumption. This intelligent system maximizes efficiency and ensures a reliable power supply.
- **Energy Storage:** Excess energy generated from solar, tidal, and kinetic sources is stored in advanced battery systems, providing a consistent power supply even when sunlight is limited or tides are low.

Benefits Beyond Energy
- **Research and innovation:** The integrated energy systems provide a real-world laboratory for studying renewable energy technologies in a challenging marine environment, pushing the boundaries of innovation.
- **Education and public engagement:** The platform's visible commitment to sustainable energy serves as a powerful educational tool, inspiring visitors and showcasing the potential of a multi-faceted approach to harnessing the ocean's power.

8.2 WATER MANAGEMENT

Given the platform's unique location, this project will prioritize water conservation, innovative recycling methods, and responsible wastewater treatment to ensure a sustainable and reliable water supply.

1. Conserving precious resources
- **Minimizing water usage:** Implementing water-efficient fixtures and appliances throughout the platform will be crucial. Low-flow toilets, faucets, and showerheads will be installed. Laboratories will utilize water-saving equipment and practices.
- **Leak detection and repair:** A proactive approach to leak detection and repair will prevent unnecessary water loss. Regular inspections and maintenance of plumbing systems will be essential.

2. Maximizing water recycling
- **Greywater recycling:** Greywater from sinks, showers, and laundry facilities will be treated and reused for non-potable purposes, such as toilet flushing and irrigation. This reduces the demand for freshwater and minimizes wastewater generation.
- **Rainwater harvesting:** The platform's surfaces will be designed to collect rainwater. This harvested water can supplement the freshwater supply for non-potable uses, further reducing reliance on external sources.

3. Responsible wastewater treatment
- **Advanced treatment system:** An advanced wastewater treatment system will be implemented to remove pollutants and contaminants from wastewater generated on the platform.
- **Water reuse:** Treated wastewater will be reused whenever possible for non-potable purposes, maximizing resource recovery and minimizing discharge into the surrounding marine environment.

4. Desalination
- **Seawater desalination:** While energy-intensive, desalination will be explored as a potential option for supplementing freshwater supplies, especially during periods of low rainfall or increased demand. Renewable energy sources powering the platform could make desalination more sustainable.

5. Monitoring and Education
- **Water consumption monitoring:** Smart monitoring

systems will track water usage throughout the platform, providing data to identify areas for improvement and optimize water conservation efforts.

8.2 WASTE MANAGEMENT

A sustainable waste management strategy for an offshore research center

This project will implement a comprehensive strategy to minimize waste generation, maximize resource recovery, and demonstrate a commitment to environmental responsibility.

Minimizing waste, Maximizing resources

- **Reduce, Reuse, Recycle:** The guiding principle will be to reduce waste at its source. Procurement will prioritize products with minimal packaging and favor reusable items. Laboratories will utilize reusable labware and implement innovative methods for reusing materials within experiments. A comprehensive recycling program will ensure that materials are properly sorted and processed.
- **On-site treatment:** Organic waste from kitchens and other areas will be composted on-site, potentially enriching a platform garden or being donated to mainland facilities. Advanced wastewater treatment will remove pollutants and recycle water for non-potable uses, minimizing discharge into the surrounding marine environment.

Reducing environmental impact

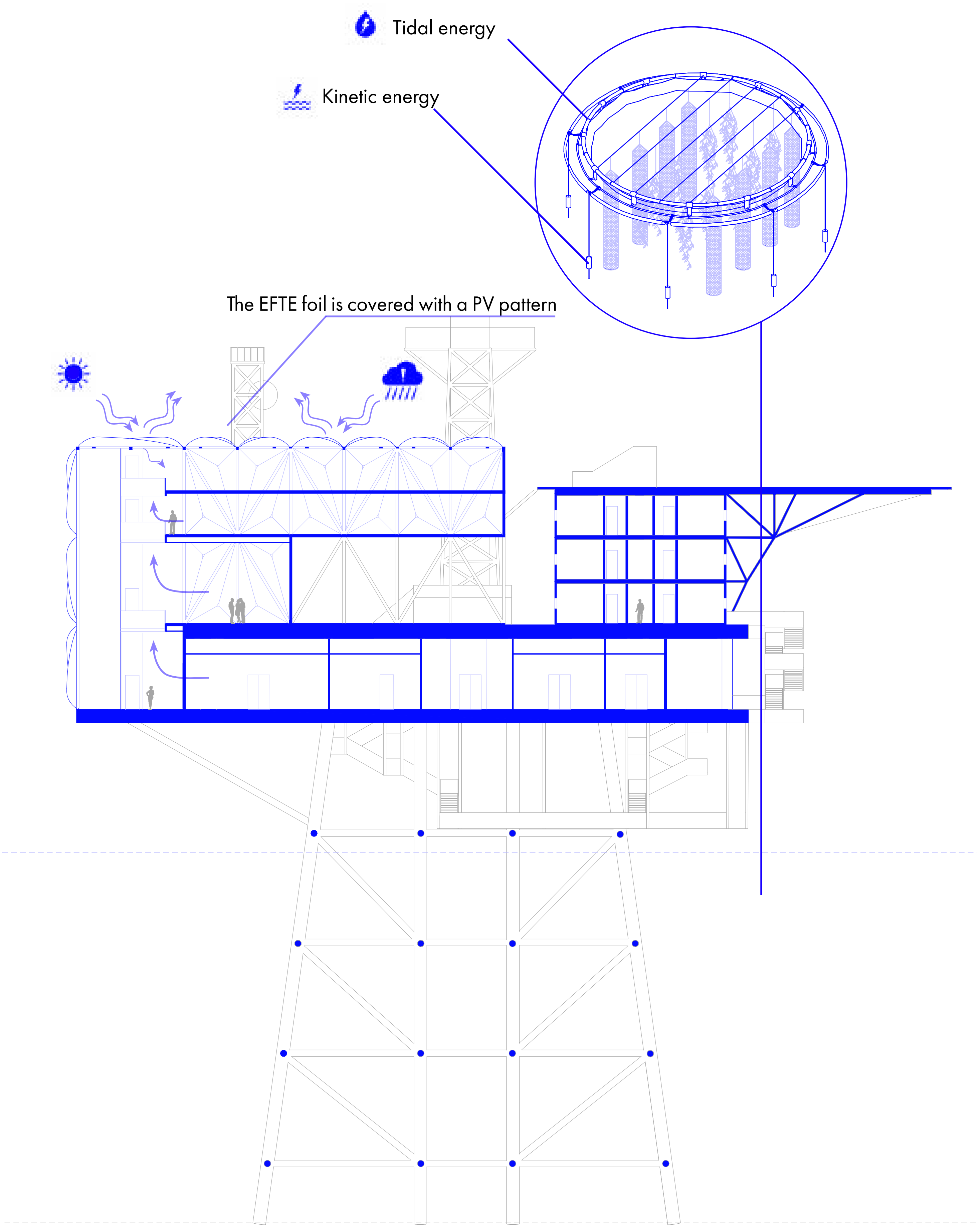
- **Minimizing off-platform transportation:** Recyclable materials and residual waste will be compacted and securely stored to reduce the volume requiring transportation to mainland facilities. Transportation schedules will be optimized to ensure full loads, minimizing trips and associated emissions.

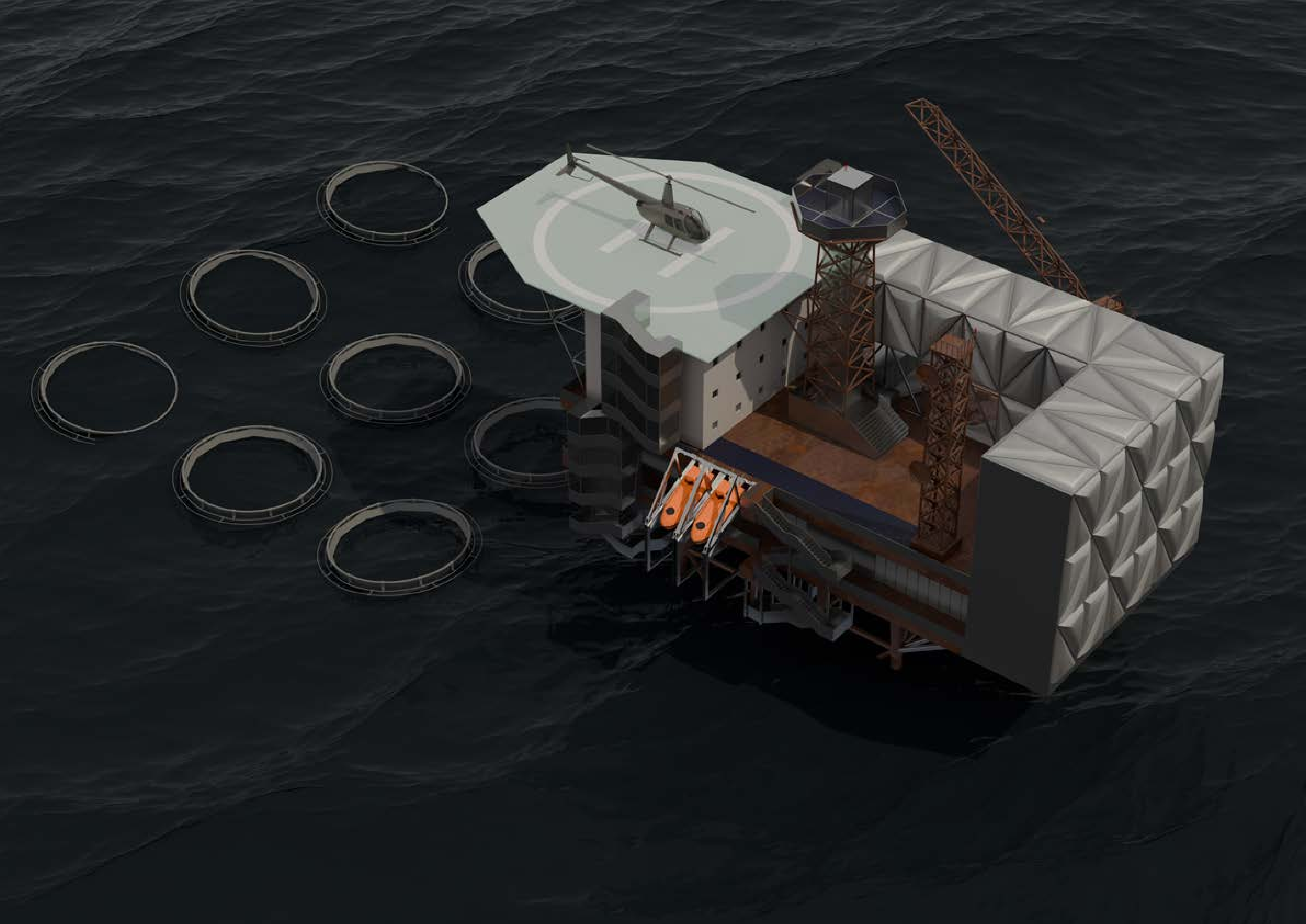
8.3 FOOD PROVISIONING

Sustainably and reliably providing food for the crew requires careful consideration of logistical challenges and environmental impact. Our approach incorporates a multi-faceted strategy that leverages local resources, minimizes waste, and ensures the delivery of fresh, nutritious meals.

- **Optimizing logistics for essential supplies**: Given the inherent space limitations of an offshore platform, regular helicopter deliveries will be essential for a portion of the food supply. However, to minimize the environmental footprint associated with air transport, we will implement a demand-based inventory management system. This system will analyze consumption patterns, predict needs, and optimize delivery schedules to reduce waste and ensure freshness. Additionally, the partnerships with suppliers on the mainland will be considered to source locally-produced, non-perishable goods, further reducing transportation distances and supporting regional economies.
- **Cultivating freshness onboard:** To complement external supplies and enhance sustainability, the platform will feature a state-of-the-art hydroponic system. This controlled environment agriculture will provide the crew with a constant supply of fresh, flavorful vegetables and herbs grown using minimal water and resources. The hydroponic system will be designed to maximize yield within the platform's spatial constraints, aiming to fully meet the crew's green consumption needs. Furthermore, regular monitoring and adjustments to lighting, nutrient levels, and growing cycles will ensure optimal production throughout the year.
- **Harnessing the adriatic's bounty:** The Adriatic Sea offers an abundant source of fresh seafood, presenting a unique opportunity to integrate locally-sourced protein into the platform's dietary plan. This provides the crew with access to fresh, flavorful seafood, reducing reliance on land-based protein sources and their associated environmental impacts.

By combining efficient logistical solutions, on-site food production, and responsible sourcing of local seafood, the reconstructed platform will strive to create a sustainable and resilient food system that prioritizes the health of both the crew and the surrounding ecosystem.





České vysoké učení technické v Praze, Fakulta architektury

2/ ZADÁNÍ diplomové práce

Mgr. program navazující

jméno a příjmení: Ramina Khakimova

datum narození: 21.04.1999

akademický rok / semestr: 2023/2024
obor: architektura a urbanismus
ústav: 15116 ústav modelového projektování
vedoucí diplomové práce: doc. Ing. arch. MILOŠ FLORIÁN, Ph.D.

téma diplomové práce: (AJ) Iron Island
viz přihláška na DP

zadání diplomové práce:

1/ Popis zadání projektu a očekávaného cíle řešení
Cílem projektu je adaptovat vyřazenou mořskou ropnou plošinu u italského pobřeží v Jaderském moři na výzkumné ekologické centrum.

2/ Pro AU/ součástí zadání bude jasně a konkrétně specifikovaný stavební program
Pro D/ součástí zadání budou jasně a konkrétně specifikované jednotlivé fáze projektu, které jsou nezbytnou součástí řešení
Obsah ropné plošiny: výzkumné ekologické centrum + ubytování hostujících výzkumných pracovníků; výstavní, přednáškové a jednací místnosti, které mohou být přístupné i veřejnosti; občerstvení; propojení mořské přírody se samotnou plošinou.

3/ Popis závěrečného výsledku, výstupy a měřítka zpracování
Kontext zadání: analytická část; koncept
Situace: 1:2000 - 20000
Půdorysy 1:200-500
Pohledy a řezy 1:200-500
Axonometrie
Vizualizace
Součásti projektu mohou byt i další výstupy plynoucí z vývoje návrhu potřebné k plnohodnotné prezentaci. Výstupy i měřítka mohou být po dohodě s vedoucím DP upraveny.

4/ Seznam dalších dohodnutých částí projektu (model)
Fyzický model
Portfolio formátu A4 2x
Plakat formátu 4xA1

Datum a podpis studenta 14.2.2024

Datum a podpis vedoucího DP 14.2.2024 Miloš Florián

Datum a podpis děkana FA ČVUT

registrováno studijním oddělením dne 14/2/24

ČESKÉ VYSOKÉ UČENÍ TECHNICKÉ V PRAZE **FAKULTA ARCHITEKTURY**		
AUTOR, DIPLOMANT: Bc. Ramina Khakimova AR 2023/2024, LS **NÁZEV DIPLOMOVÉ PRÁCE:** (ČJ) **Železný ostrov** (AJ) **Iron Island** **JAZYK PRÁCE: AJ**		
Vedoucí práce:	**doc. Ing. arch. MILOŠ FLORIÁN, Ph.D.**	**Ústav: 15116 ústav modelového projektování**
Oponent práce:	**prof. Ing. arch. VLADIMÍR ŠIMKOVIČ, Ph.D**	
Klíčová slova (česká):	Adaptivní opětovné využití, Centrum pro výzkum moří, Jaderské moře, Udržitelnost, Offshore architektura, Znečištění mikroplasty, Okyselování oceánů, Obnovitelná energie	
Anotace (česká):	Tato diplomová práce se zaměřuje na adaptivní využití opuštěné ropné plošiny v Jaderském moři a její přeměnu na moderní centrum pro výzkum moří. Projekt, reagující na naléhavé environmentální výzvy, usiluje o vytvoření symbiotického vztahu mezi architekturou a mořským prostředím. Návrh integruje moderní laboratoře, udržitelnou akvakulturu a technologie obnovitelných zdrojů energie do stávající offshore struktury. Práce zkoumá možnosti sanace mikroplastů pomocí farem s mušlemi, pěstování řas k boji proti okyselování oceánů a využití energie přílivu a odlivu pro energetickou soběstačnost. Prostřednictvím detailní analýzy materiálových řešení, strukturálních úprav a principů udržitelného designu projekt dokládá, jak může architektura aktivně přispívat ke zdraví a odolnosti Jaderského moře. Tento příklad adaptivního opětovného využití slouží jako model pro transformaci offshore infrastruktury v měnícím se světě.	
Anotace (anglická):	This diploma thesis reimagines an obsolete oil platform in the Adriatic Sea as a cutting-edge marine research center, addressing pressing environmental challenges through a symbiotic relationship between architecture and the marine environment. The design integrates state-of-the-art laboratories, sustainable aquaculture, and renewable energy technologies within the existing offshore structure. The thesis investigates microplastic remediation using mussel farms, algae cultivation to combat ocean acidification, and harnessing tidal and wave energy for a self-sufficient energy system. Through detailed analysis of material solutions, structural enhancements, and sustainable design, the project demonstrates architecture's ability to contribute to the health and resilience of the Adriatic Sea. This adaptive reuse serves as a model for transforming offshore infrastructure in a changing world.	

Prohlášení autora

Prohlašuji, že jsem předloženou diplomovou práci vypracoval samostatně a že jsem uvedl veškeré použité informační zdroje v souladu s „Metodickým pokynem o etické přípravě vysokoškolských závěrečných prací."

V Praze dne podpis autora-diplomanta

Tento dokument je nedílnou a povinnou součástí diplomové práce / portfolia a CD.

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