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F.U.S.S.

Floating Units for SeaSteading

Executive summary

Rising sea levels are tearing more and more coastlines from the earth, submerging cities, ecosystems and entire cultures. F.U.S.S. (Floating Units for SeaSteading) is an **innovative system of artificial floating platforms** designed to host life, facilitating the construction of human settlements on the water and ensuring their well-being through the creation of a closed ecosystem of goods and services. F.U.S.S. represents an essential first step towards adaptability to new lifestyles in harmony with an evolving environmental apparatus that we must learn to respect and coexist with, a social migration that reinterprets the concept of the city and participates in the personification of the future.

The basic module of the project is composed of **hexagonal concrete platform 50 metres in diameter and 8 metres high**, made buoyant thanks to air chambers inside the structure; the dimensions were carefully identified to balance the architectural and engineering requirements of the superstructure without compromising the limits of stability and flexibility that must be observed in the open sea; an essential combination of design and engineering has been adopted to favour a gradual transition from traditional ways of living on land to a new lifestyle on the water. The project follows a **design mentality typical of the Italian culture** identifiable in social relationships and in the authenticity of its handcrafted products an undisputed strong point in the field of sustainability; these factors are translated into common urban spaces, light and modular building materials produced using low environmental impact techniques, an architecture permeated by internal courtyards, porticoes and balconies that integrate the enclosed spaces with the outdoors, and green areas used for biodynamic farming of seasonal foods that support a vegetarian and Mediterranean diet.

While the vision of a city on water may be futuristic, it is still necessary to begin the process of transition to more sustainable lifestyles as soon as possible. F.U.S.S. thus generates **SEAform**, the first floating **prototype** designed for the city of Venice and promoted by VeniSIA, a Venetian start-up accelerator, for the Architecture Biennale in 2023. The choice of the city of Venice was made to investigate the feasibility of the project through the identification of local stakeholders that can be involved in the process. SEAform is not just the initial step toward a community on water but a project to raise awareness of the future, a display of technologies to demonstrate the feasibility of the proposal.

Key Words

floating city, life on water, technology integration, sustainability, modularity.

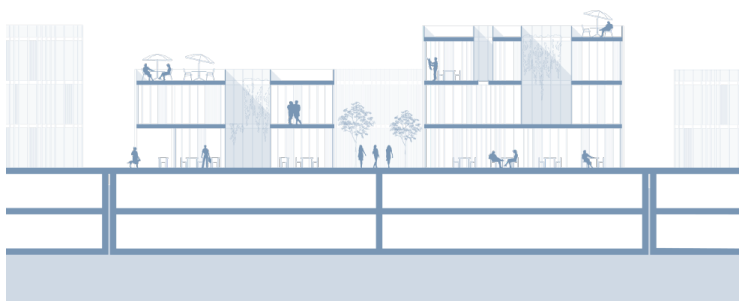


Fig. 1 Architectural section of the floating city

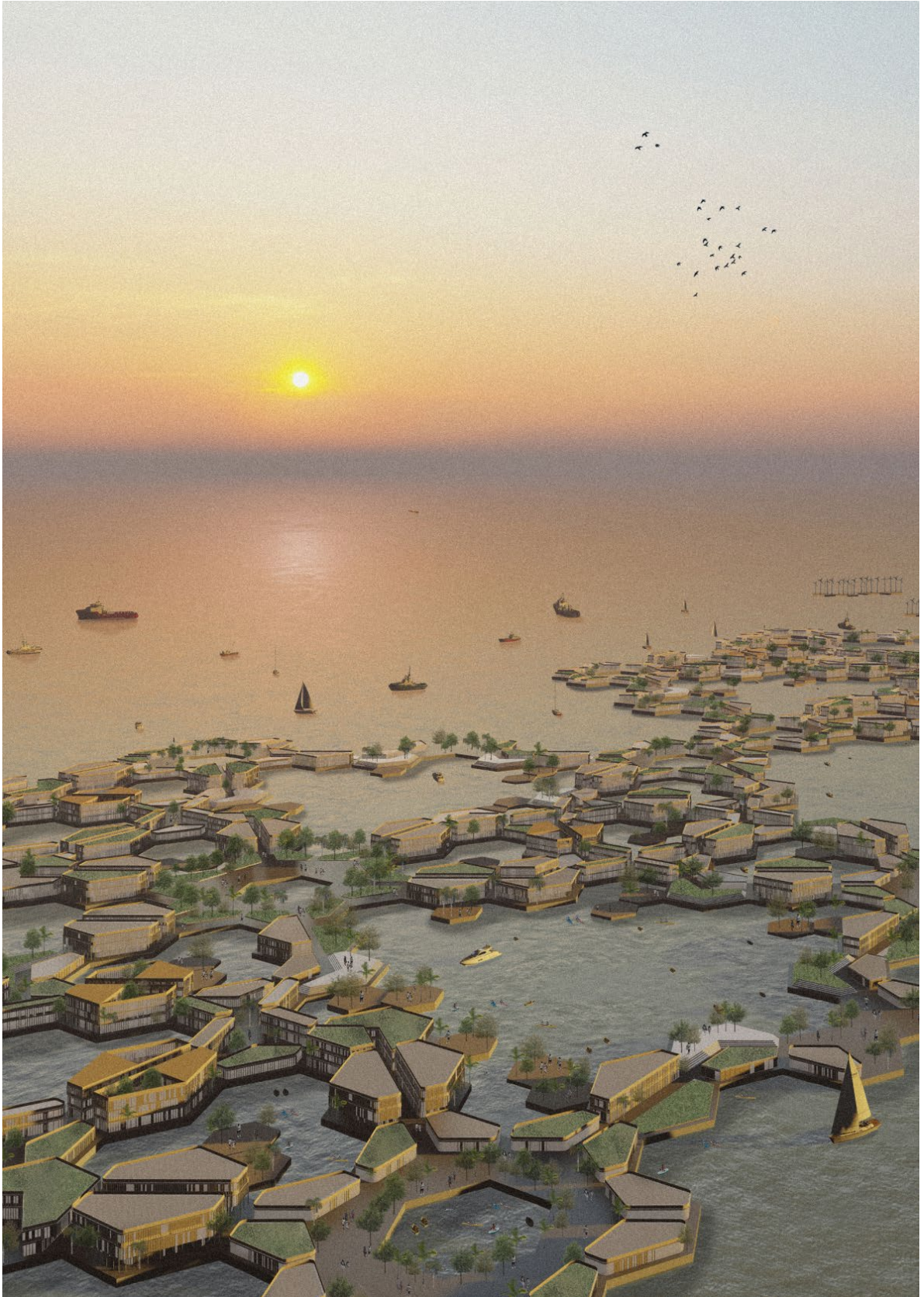


Fig. 2 Rendering view of the floating city

Project description written by the Principal Academic Tutor

The F.U.S.S. project idea was born from the **"MOREnergy Lab"** and the spin-off **"Wave for Energy"** expertise in floating structures to produce renewable energy. Using this know-how, the goal is to create a modular floating system that can be adapted to create a floating human-based activity.

Among the 17 Sustainable Development Goals that the United Nations have set in the 2030 Agenda, the goal 11 "sustainable cities and communities" aims to "make cities and human settlements inclusive, safe, resilient and sustainable". From this, the ASP Challenge started by analyzing the phenomena like urban density, land scarcity, and the rising sea levels problem related to climate change in order to understand the next generation's needs and to explore the feasibility of a self-sufficient and sustainable community.

The first aspect that they went over was an accurate state of art analysis, exploring the different forms of living on water from the first aboriginal floating communities to the contemporary floating structures. Then, through a deep market and site analysis, the possible locations to be used, for a case study project, had been identified.

In this way, it was possible to define a project's concept idea and elaborate a feasibility analysis with respect to topics such as technology, performance, sustainability, and social/economic impact.

The team carried out a first architectural design concept of a floating module, made of sustainable materials easily to assemble and capable of exploiting renewable energy resources. Starting from the single module, the Team proceeded with the configuration of some optimal layouts for the development of a floating community, which allows it to be independent and autonomous, through innovative technologies and solutions, in terms of energy, food and water production, and waste management.

After the first proposals and design analyses, the team started to face up to the engineering limits (stability, comfort, and safety requirements), thanks to the discussions had with the engineers of the MoreLab team. This cooperation raised up a joint work phase regarding both the floating unit engineering and the identification of possible markets.

In collaboration with the research team, together called "Seaform", and thanks to the interaction with local stakeholders, it was also possible to define and design a first prototype: a "Floating Pavilion" studied and designed for the Biennale of Architecture that takes place in the city of Venice.

The students carried out the project with creativity, accuracy, and determination, allowing to achieve, not only the objectives set for the ASP Challenge, but significantly contributing to a project that will be carried out and developed by the Seaform team with the aim of achieving the establishment of an academic spin-off.

Team description by skill

The F.U.S.S. team is composed of five students with architectural background, one designer and one engineer. For the first six months the team focused on researching information about the state of art, the existing competitors and the different technologies and materials that could be implemented in the floating city.

In particular, the five architects, **Agata, Sara, Ilaria, Ludovica** and **Benedetta** took care of the super-structure's design, thinking about the organization, the shape, the materials of the buildings, and the urban configuration, with the integration of the different services and technologies needed; **Edoardo**, the Service and System Designer, focused on the value proposition of the project and the social impact that the project would have on the population; and finally, **Marta**, who studies Building and structural engineering, took care of the design of the under-structure, choosing the best materials, the dimensions and studying how to actually make the platform float.

Goal

In 2015, the United Nations drew up the **2030 Agenda** for the sustainable development of member countries, thus agreeing a shared blueprint for promoting a climate of peace and prosperity for people and the planet. The heart of the program is contained in 17 SDGs (Sustainable Development Goals) and the eleventh point addresses the sustainability of cities and communities aiming at "making cities and human settlements inclusive, safe, resilient and sustainable".

The purpose of this project is to illustrate how one of the most devastating consequences of the greenhouse effect, the rise in sea level and the consequent subsidence of the land, can provide a creative starting point for **rethinking the concept of life and the city, through a slow migration of settlements and communities on the sea**. The goal is to build a new **sustainable model** capable of responding to urgent climate and demographic crisis. This will be possible through the engineering of artificial floating platforms capable of hosting people and services and guaranteeing the autonomy of primary resources such as food, water and energy by exploiting sustainable and avant-garde technologies.

In particular, F.U.S.S.' aim is to create a **real community**, living and carrying out its activities independently in the floating city; its intent is to bring a valuable impact to the **socio-cultural ecosystem** where the city will be located, waiting for the vision of a new self-sufficient floating community to create its own social roots.

Understanding the problem

The continuous **increase of the global population** and the consequent urbanization implies the pressing need for new housing for living and buildings to allow the functioning of the new neighbourhoods. This involves a **densification** of cities, with a vertical development of new buildings or the urbanization of previously rural areas. Cases in which, however, this is **no longer a sustainable strategy** due to the unavailability of new lands or the saturation of the city system which, already pushed to its maximum capacity, forces the use of other solutions.

Moreover, there is the problem of **rising sea levels**, which in the future will lead to the disappearance of a large portion of the coasts and especially of small islands. These types of problems have pushed towards the possibility of exploiting a resource previously seen as border: **water**.



Fig. 3 Europe new coastline in 2100 after the increase of sea level

Although this is a problem that has only recently developed, human's relationship with water has very ancient origins. Water has been for some communities the element with which to share their daily life. **Majuli** (India) and **Makoko** are two communities that live on water; but also, the **Netherlands** is appropriating its own waters and building platforms capable of floating and hosting buildings and life on them.



Fig. 4 Majuli (India)



Fig. 5 Makoko (Nigeria)

The hypothesis of the use of the sea surface through the construction of floating platforms that replace the use of new land surfaces, implies the need to make these new cities equipped with all the **services** present on the mainland. We wondered how to make the new city on water **self-sufficient** for food and energy production and waste management, able to provide its needs in a sustainable way.

However, there are problems concerning the **socio-cultural** sphere: the **introduction** of people onto the platform with the initiation of a relational network and the **resilience** of the community in the long term. It's important to understand how to facilitate the transition **from land to water**.

Exploring the opportunities

As explained in the previous section, one of the main issues is the need to create **self-sufficient** living cores with regard to all services that would be present on the mainland. A first issue concerns **energy production** for which partial dependence on the mainland was initially assumed. Various reasonings, however, have pointed out the unsustainability of such an approach, both because of the locational limitation that imposes proximity to a center on the mainland, with consequent land consumption and management difficulties, and because of the cost in economic and energy terms that transporting energy would entail. For this reason, it was decided to make the city self-sufficient by implementing technologies that could provide for its needs in a sustainable manner, producing the energy **locally and in a clean way**. Possible solutions in this regard were identified as **solar energy**, with panels to be integrated into the roofs of buildings, facing south as much as possible; **wind energy**, produced through dedicated platforms near the city; energy derived from **wave motion**; and **algae panels**.

Similar reasoning has been made regarding **food production**, which should take place directly on floating platforms. For this, solutions such as **aquaponics** and **aeroponics** have been sought that allow food to be obtained with reduced consumption of land and depletable resources. It also turns out to be necessary to reduce the amount of non-recyclable products and, when possible, to adopt a self-recycling system that **minimizes waste**.

Another issue that had to be addressed was the **configuration of the city**: the shape and size of the platforms, chosen not only on the basis of technical criteria related to stability and ease of connection, but also on social and architectural factors, and the ways in which they would interact and aggregate, which would have to respond to a particular idea of the city that would give a hint of use and facilitate the creation of a real **community**, placing special emphasis on the relationship with water, the protagonist of the entire intervention.

Before starting with such an ambitious project, it is also necessary to ask what is the most suitable **location** to realize it. There are various settlements in the world that for various reasons may need to expand beyond the land border. By way of example, we could talk about Hong Kong, a highly densified city whose territorial conformation does not allow it to expand towards the mainland, or the case of some islands in Polynesia, which, due to rising sea levels are destined to disappear. Looking instead at the Italian context, **Venice** is the city that is most affected by these changes, going to be a privileged place in which to settle a project that is born in Italy and wants to realize an intervention that brings with it the atmosphere of the Italian city, even beyond the boundaries defined by the mainland.

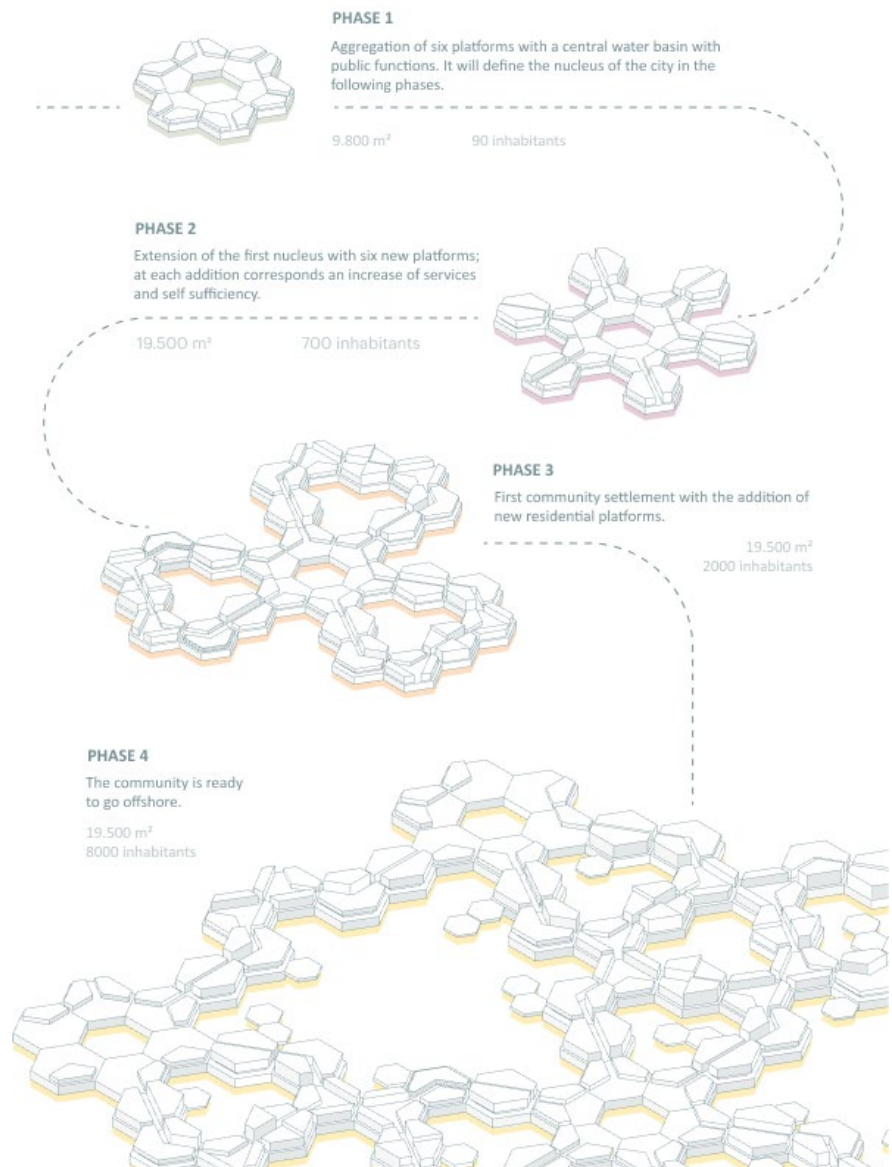


Fig. 6 Urban development of the city

Generating a solution

Venice, "Italy's floating city," was eventually chosen as the **project location** because it represents the city in Italy with the greatest potential to host F.U.S.S. platforms. In addition to being particularly susceptible to climate change, its culture is closely linked to water. Moreover, in recent years it has been undergoing a strong process of depopulation caused by living conditions that no longer meet today's needs. The goal of reversing this trend by offering a new territory open to change and which responds to the danger of rising seas, makes Venice an ideal location to base the thoughts of a floating city.

The **creation of the city** represents though the **ultimate goal** of the research and design efforts. It is a very complex system of interrelationships between strategic vision, architecture, technologies used and economic planning, all this always relating to the needs and expectations of the numerous stakeholders involved. For this very motive it was immediately clear that we needed to **proceed by phases**.

The first phase involves the creation of a core of six 50 m diameter platforms that will house mostly public functions with the purpose of publicizing the project, usable by outside visitors. The space dedicated to residence will be rather small and arranged mainly at the edge of the core, in direct contact with the water. If the first phase is about getting to know the product, the second is about self-sufficiency. The initial core expands with the addition of six platforms dedicated to residence and to the first functions related to the realization of what is necessary so that the system can be made independent from the mainland. This implies the production of energy, food and the on-site management of waste. The last phase is dedicated to the creation of a real community, which lives and carries out its activities independently in the floating city. Also in this case, the expansion is progressive, initially through the addition of 15 platforms mainly used as residences and services for people.

It is important to emphasize the **urban conformation** of the city given by the design of the **superstructure**, which is strongly inspired by Italian cities and, in particular, by the concepts of *portico* and *piazza*, which acquire a central role as places of meeting and interaction. The first core mentioned above is in fact developed around a water basin that is configured as a square. Starting from this core, a series of streets are then articulated, connecting the various parts of the city, always directing and attracting the user to the above-mentioned squares.

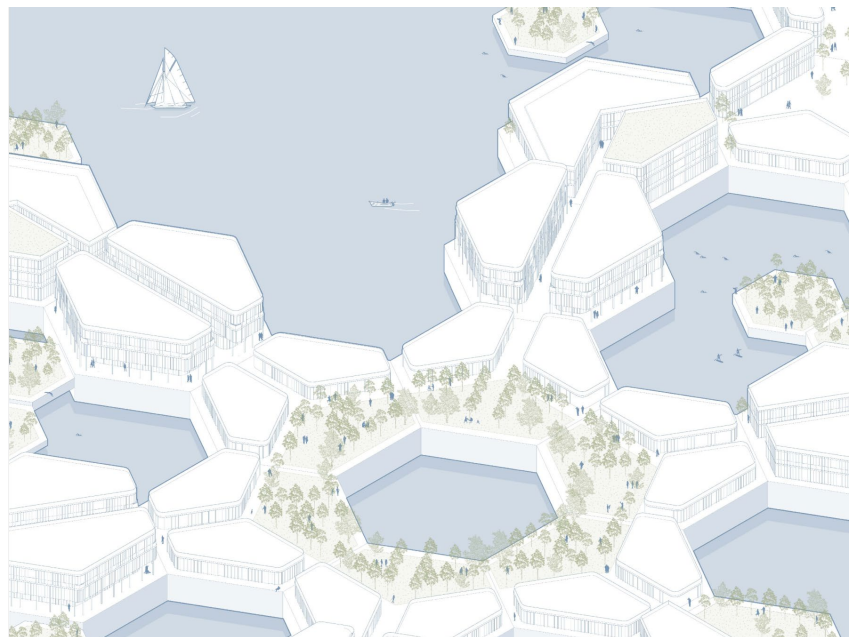


Fig. 7 Axonometric suggestion of the city

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