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## 2. Off-Shore Structure for Future Marine City (Japan)

Owner: Government of Japan

Engineer and Contractor: Mitsubishi Heavy Industries Co.Ltd.

Type of Structure: Trussed rigid frame with 4 lower hulls and 16 columns (semi-submersible)

### Dimensions

Length: 104 m

Width: 100 m

Height: from lower hull base to main deck: 26 m  
from lower hull base to sub-deck: 29.15 m

from lower hull base to roof deck: 32 m

External lower hull: length = 56 m, width = 10 m,  
depth = 6 m

Internal lower hull: length = 104 m, width = 10 m,  
depth = 6 m

Column: 12 large columns; 7.5 m diameter  
4 small columns; 3 m diameter

Main deck: 100 x 100 m, including projected part

### Performance

Operating ocean conditions:

Atmospheric temperature:  $-10^{\circ} - 40^{\circ}\text{C}$

Water temperature:  $\leq 32^{\circ}\text{C}$

Humidity:  $\leq 85\%$

Tide:  $\leq 3\text{ m}$ , Tidal current:  $\leq 1.5\text{ kt}$ ,

Wind velocity:  $\leq 85\text{ m/sec}$ .

Wave height:  $\leq 15\text{ m}$ , Depth of water: 10 – 70 m

Towing distance: 200 m by wind lasses

Draught: 5.4 – 20 m

### Stability:

Limit restoring angle:  $> 35^{\circ}\text{C}$

Restoring moment/Wind pressure moment:  $> 1.3$  at submer-  
sion angle

### Main Facilities

Volumes of main tanks

Ballast tank (25 in lower hulls): 14,032 m<sup>3</sup>

Columns (8): 2,118 m<sup>3</sup>

Fuel tank: 352 m<sup>3</sup> x 2 tanks

Drinking water tanks: 293 m<sup>3</sup> x 2 tanks

Main generator: 1500 kVA (1200 kW) x 2 generators

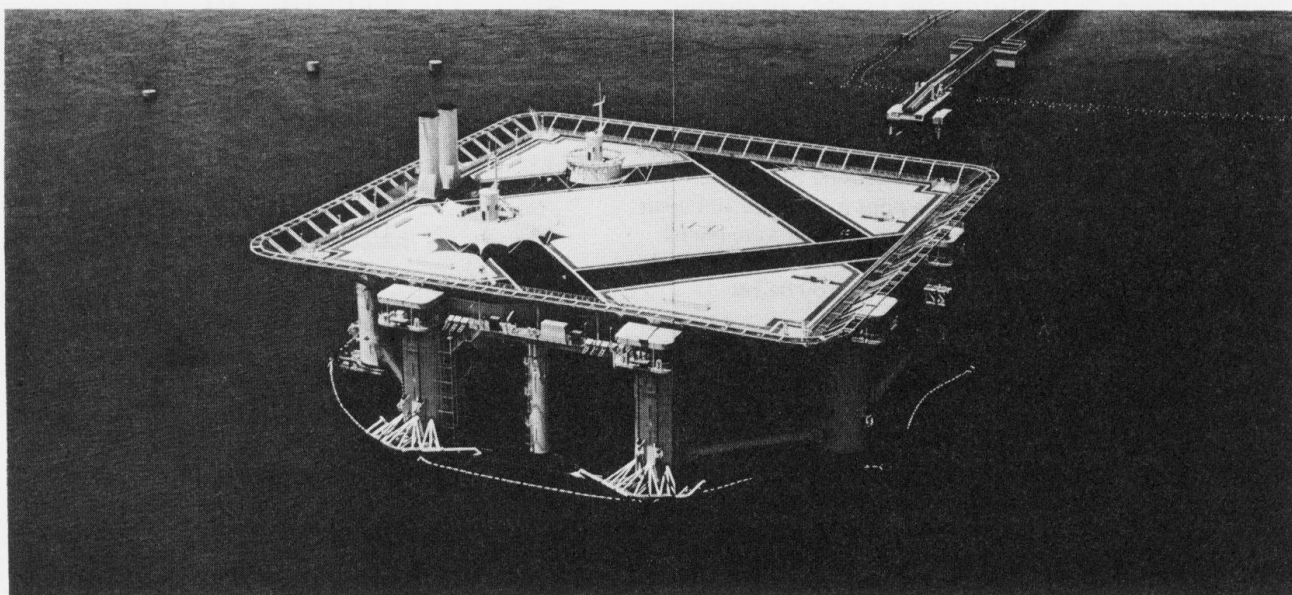
Diesel engine: 1800 ps x 720 rpm x 2 engines

A semi-submersible, floating type off-shore structure, AQUAPOLIS, was built as a symbolic monument of the Japanese Government at the 1975 Okinawa Ocean Exposition. It is one of the largest off-shore structures in the world. AQUAPOLIS was designed to be a first genuine marine city and intends to be a base of human activities that will launch us into the sea.

In spite of the subtropical climate and the disadvantageous location that suffers frequent typhoons, it was built with every possible care to establish comfortable residential environment in the sea and to preserve the natural ocean environment as well as to maintain safety, with the help of today's most advanced technologies.

AQUAPOLIS is outlined with the emphasis on its structural aspect. (Quoted from the official book prepared by the Aquapolis head office, Okinawa Ocean Exposition).

The total system includes the AQUAPOLIS, the Aquabridge as the access from the shore, and the attached underwater ranch. Following is only on the AQUAPOLIS.



## Outline of Structure and Facilities of AQUAPOLIS

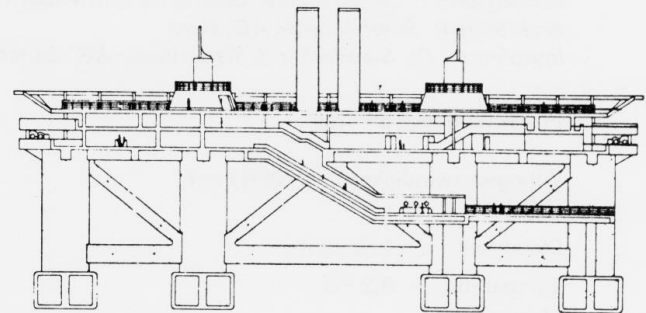
AQUAPOLIS is located 400 meters off the shore and is a semi-submersible off-shore structure. On the four lower hulls (semi-submersible), the main bottom deck is supported by 16 columns which are connected by horizontal and vertical bracings. The sub-deck and the top roof deck are built on the main deck.

By supplying and draining water to and from the ballast tanks, the entire structure can be drawn between 5.4 m deep for towing and 20 m deep of semi-submerged position to enable people's approach to the structure. When in the stormy weather, the draught is set either at 12.5 m or 15.5 m deep depending on the wave height.

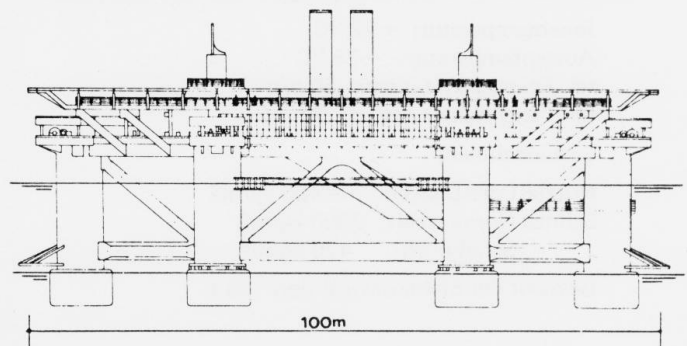
There are boat harbor, hall offices, restaurant, medical center, mechanical room, and exhibition corner on the main deck, and on the sub-deck are special room, executive room, employees' office, central control room, utility control room, computer room, press center, etc. The roof deck is an open plaza covered by artificial and natural lawn (hydroponics) and has a heli-port on its center.

For the AQUAPOLIS, a closed system was adopted as a model case of marine city. In order to facilitate the structure independent from the shore life, and to pay attention not to pollute the surrounding sea, there are such equipments as diesel generator, desalination plant, sewage treatment, incinerator, water-oil separator, etc.

(Takenaka Komuten Co., Ltd.)



Section



Elevation

