TECHNICAL NOTE

OFFSHORE AND COASTAL FLOATING HOTELS: FLOTELS

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SUMMARY

This paper considers the structures used today in the maritime and ocean industries to accommodate people in semi-permanent accommodation at sea: the floating hotels, or *flotels*. They have mainly been developed to support the activities of the offshore oil & gas industry, although in coastal areas they are widely used for several purposes, mainly as commercial hotels, but with a quite different philosophy of use. The objective of the paper is to show how the term *flot*el is used to denominate very different craft that, while serving the same purpose (provide floating accommodation), have a totally different configuration according to the place where they are located: in protected waters in coastal areas (where the craft are sometimes called *coastels*), in benign and shallow waters of the open ocean or in the harsh environments of deep waters, etc.

1. INTRODUCTION

Many people speak about ocean colonization as the future of human expansion as it is the next frontier to be conquered, and as an intermediate step before space colonization (Ref.1 and.2). But the ocean has already been colonized since the last century as it is one of Earth's most valuable natural resources:

- It provides food in the form of fish and shellfish.
- It is used for transportation, both travel and shipping.
- It provides a treasured source for human recreation: cruise vessels, yachts and sailing.
- It is mined for minerals: salt, sand, gravel, and some manganese, copper, nickel, iron, and cobalt can be found in the deep sea.
- It is drilled for crude oil and gas.
- It is an important source of renewable energies: wind, waves, current, tidal, thermal, etc.

To enable the exploitation of these resources, the ocean industry has needed to accommodate people at sea in safe and comfortable conditions from the very beginning. This accommodation is normally included in the working ship or platform, but sometimes dedicated accommodation vessels are used.

Accommodation vessels or *flotels*, represent the state of the art of maritime and offshore technology for offering semi-permanent floating accommodation at fixed locations in bays, seas and ocean. *Flotel*, or *floatel*, a combination of the terms *floating* and *hotel*, refers to the installation of living quarters on top of barges, ships, craft or semi-submersible platforms. Flotels are used as hotels on rivers, in bays, in harbour areas or as accommodation for working people in the open ocean, especially for the offshore oil industry. They are also called c*oastels* when designed for coastal waters: this is also a combination of the terms *coastal* and *hotel*.

The paper starts with a brief study of coastels. Then, it continues with offshore flotels. In each of the sections, we present a craft that it was chosen as representative of each category of floating hotel. They have been categorized in accord with the rules of the International Maritime Organization and Classification Societies.

2. COASTELS

2.1 INTRODUCTION

Coastels are floating accommodation vessels which can be anchored or moored alongside a berth or quay, in rivers, bays, off calm beaches or in harbours. They can be chartered for short or long term use and utilized during the early development of a project or throughout a project's life. Although the main use of coastels s is as commercial hotels, they also offer a range of capacities and facilities for a variety of uses, such us:

- Floating detention centres.
- Shipyard worker accommodation.
- Power stations.
- Bridge building.
- LNG projects.
- Temporary offices and training facilities.
- Accommodating military personnel.
- Refugee accommodation.
- Casinos.
- Student accommodation.
- Hospital facilities.
- Corporate HQ for events in remote areas.

They have the disadvantage of being suitable only for calm waters close to the coast and not for open ocean waters, where waves, wind and current are greater. They are usually non self-propelled barges or pontoons and so need tugs for movement.

Figure 1: a coastel being tugged at Coruna bay.

2.2 CLASSIFICATION

In the past, most of the coastels were classed under the class notation *Floating Hotel*. For example, if we look up into the Det Norske Veritas (DNV) rules we find the following for this old class notation:

- Class notation: Floating Hotel
- Description: Vessel with accommodation for guests at stationary locations in protected waters.
- Application: Passenger ships, mandatory as of July 1995
- Remark: Service restriction RE part of main class
- Date entered into the rules: P
- Date of last issue: July 1997

Therefore, this class notation is not used since 1997. Flotel 92, as we will see later, is a good example of this old notation. Nowadays, they are just classified as *Pontoons*, while the hotel or accommodation facilities on the pontoon are built under passenger ship SOLAS regulations, as in the past. Sometimes the hotel part also complies with the civil building rules of the country in which they are intended to operate.

For example, DNV normally classifies coastels as:

- Type: 713 – Hotel Barge
- Notation: ✠1A1 RE Pontoon

As per DNV rules:

- Barge: Ship type class notation for barges or pontoons without sufficient means for self propulsion for their service area.
- Class Notation RE: defines a service area restriction.
- Purpose: The notation is offered to vessels that are designed for a particular service. The notation is generally applicable to small vessels and normally less than 100 m long.
- Benefits:
    - adjustment of design loads based on the limited service area.
    - retaining the same safety level as for vessels operating without service area restrictions is retained.
    - may result in reduced building or conversion costs.
- Features: This notation indicates that the service area is restricted to enclosed fjords, lakes or rivers.

Therefore, and as will be seen in the classification of offshore flotels, the rules applied to flotels moored to a harbour/quay are not the same as those applied to a flotel barge in open ocean waters. At a first glance, they seem to be similar to Offshore Accommodation Work Barges, but a study of the rules shows that the stability, structural or safety requirements are not so strict, as explained in the previous paragraph by DNV.

While barges and pontoons are the most common structure for a coastel, cruise vessels are used in some instances for the same purpose, just moored at a quay. In the following paragraphs are shown two examples: *Flotel 92*, with the old class notation *Floating Hotel* and used as a commercial hotel; and *Jascon 27*, used for yard workers accommodation with the new class *RE Pontoon*.

2.3 COMMERCIAL FLOATING HOTELS

The main use of coastels is as floating hotels. For a better understanding of this use and it technical issues, included here is an example.

2.3 (a) Flotel 92

This is a project of the 1980s from the old Spanish yard ASTANO for a floating hotel with 1000 rooms whose main purpose is to offer provisional accommodation for cities with insufficient hotel capacity when an important event is celebrated. In principle it was considered for events such as the 1992 Summer Olympic Games celebrated in Barcelona, Spain.

Figure 2: artistic view of Flotel 92.

This hotel was designed as an autonomous unit, for anchoring to the bottom or mooring to a quay in rivers, bays, calm beaches or harbours with a minimum depth of 4 or 5 metres, with access via floating wharves or ramps. The unit is towed from one point to another when required, as it has no propulsion, and then anchored/moored. The hotel facilities are built over a steel floating pontoon in which all the machinery required for the autonomous operation is located.

It was designed under the following rules of Bureau Veritas:

- Classification and Certification of Floating Hotels and Hospitals.
- Towing at sea of ships and floating units (NI 183A – CNI).
- for obtaining the Class Notation: I3/3E FLOATING HOTEL/NP, RMC-V

Like any other vessel, this Flotel also complies with all the rules of the International Maritime Organization: SOLAS, MARPOL, COLREG, Load Lines, etc.

At the same time, the hotel facilities over the pontoon comply with the standards of the Spanish Hotel Industry, that are not maritime standards.

Although the project was cancelled, it is a good example of a commercial floating hotel on the coast. The figures below show the General Arrangement and the Midship Section.

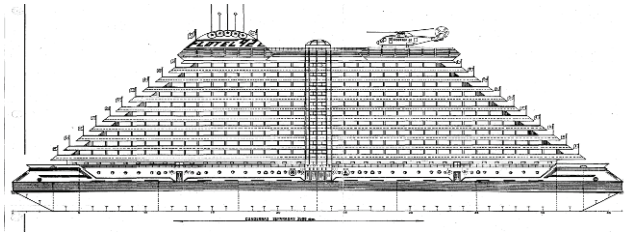


Figure 3: General Arrangement of Flotel 92.

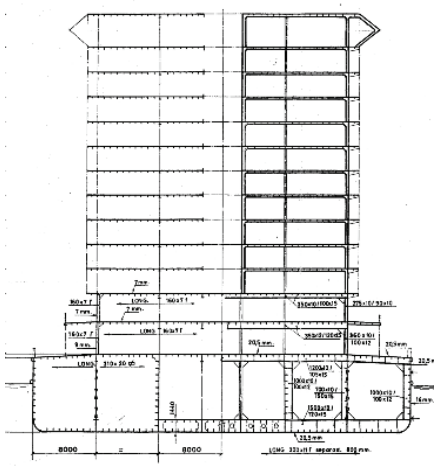


Figure 4: Midship section of Flotel 92.

Technical features:

Tonnage:	13,512 GT
Length overall:	161,00 m
Beam waterline:	48,00 m
Draught:	6,00 m
Depth:	9,00 m
Capacity:	1000 rooms

2.4 SHIPYARD WORKER ACCOMMODATION

Coastels are ideally suited to accommodate shipyard workers, as shipyards are inevitably located next to water, and typically have mooring space available for vessels. Using a Coastel to accommodate workers within a shipyard not only offers a cost-effective solution compared to using hotels or land camps, but also helps reduce logistical issues of moving workers between their accommodation and the worksite.

2.4 (a) Jascon 27

Jascon 27 is a non-propelled accommodation barge owned by Sea Trucks Group suitable for accommodating staff and workers for offshore/construction projects and able to operate in restricted/sheltered waters. It accommodates 500 oil workers and contains a galley, mess room, four games rooms, four recreation rooms and a gymnasium.

Figure 5: *Jascon 27* moored at Coruna harbour.

Technical features:

Tonnage:	-
Length overall:	101.83 m
Beam waterline:	25.8 m
Beam extreme:	25.83 m
Draught:	3.17 m
Depth:	6.1 m
Capacity:	Accommodation for 300 persons, can be increased to approx. 500 persons
Class:	Type: 713 – Hotel Barge
Notation:	DNV ✠1A1 RE Pontoon

3. OFFSHORE FLOTELS

3.1 INTRODUCTION

The offshore oil industry is the main market for accommodation vessels or flotels and these applications represent their "state of the art". Many projects have been developed in recent years, with new concepts and innovative vessels and systems promising to improve the living conditions of seafarers working in the offshore industry.

The main purpose of an offshore flotel is to provide accommodation facilities for those working on offshore

platforms or rigs, located adjacent to both fixed structures, platforms and floating units such as FPSOs, semi-submersible drill ships, jack-ups, spar platforms, etc. A means of holding position is necessary and this could be achieved by the use of a mooring/anchor system or a dynamic positioning system. Transfer of personnel between the flotel and the offshore platform is normally provided by a telescopic gangway.

Figure 6: semisubmersible flotels attached to oil rigs.

Figure 7: telescopic gangway in a semisubmersible flotel. (source: Prosafe AS).

The need for offshore flotels comes from the fact that oil platforms (FPSOs, drilling rigs,…) are designed to accommodate only those required for normal operation, which means between 100 and 200 people: For example, the FPSO "Texaco Captain" has a capacity of 200 people; the drilling rig "Stena Clyde" only 160 people. The problem comes when extra capacity is needed to accommodate workers during operations such as:

- construction and installation.
- maintenance / shutdowns / refurbishment projects.
- decommissioning.
- hook-up of satellite fields to existing infrastructure.

Not only do such operations require more accommodation, but there are other needs such as storage areas and repair workshops, lifting capacity, and diving.

The options for fulfilling these requirements of extra accommodation and services are varied, and the most appropriate will depend on the mix of services required. Table 1 shows in a schematic way those options with gross day rates and weather operational environments. Among these options, a flotel is best when the only requirement is for extra accommodation: whether accommodation is needed for 2 months or 3 years, it can be made ready within a few days. And some of them offer also extra duties, like small cranes or ROVs, but with a capacity much lower than a real offshore construction vessel. The following paragraphs study in detail each of the structures used as a flotel, but by way of introduction, Table 2 shows in a synthetic way the four main floating types of structures used as flotels.

As mentioned, flotels are positioned alongside the host installation and connected to it by means of a telescopic gangway. This also provides the rig with a "safe haven" in the event of an emergency. Together with the supply of various utilities to the installation to which it is connected, the floatels provide excellent welfare services, catering and comfortable accommodation for the offshore workforce.

3.2 TYPES AND BRIEF HISTORY

JCE Group AB (founder of Consafe Offshore AB) built the world's first purpose built flotel semi-submersible in 1977, named *Safe Astoria*. Since that time, the best solution for short-term offshore accommodation consists of the use of these flotels next to the rig. But these semi-submersible flotels also present some disadvantages:

- High cost of acquisition.
- High operation costs.
- Limited mobility.
- Lack of multipurpose operation.
- Complex connection systems.
- Highly variable operation frequency depending on adverse weather.

In 2005, *M/V Edda Fjord,* a platform supply vessel of Østensjø Group, was converted to provide accommodation services offshore Nigeria for a total of 330 people. Therefore, it is considered the first flotel ship. It supported the *Bonga* FPSO during the onsite construction, hook-up and commissioning of the FPSO facility. *Edda Fjord* was connected to the FPSO by means of a gangway and took advantage of the dynamic positioning system onboard to maintain a precise and continuous position. The living quarters were containerized accommodation modules, as shown in the picture below:

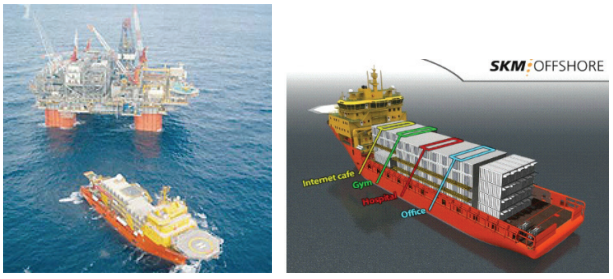


Figure 8: *M/V Edda Fjord* in operation as flotel and a virtual image with container module. (source: Østensjø Group and SKM Offshore)

In the following years, and as a consequence of the excellent performance of *Edda Fjord*, several companies decided to build their own flotel ships (Table 3 shows the current fleet, in operation and on order).

	Drilling rig	**Diving Support Vessel / Barge**	**Semi-submersible crane vessel**	**Shuttle by boat/helicopter**
				
Water depth	with DP: unlimited Moored: 300 m	Unlimited	Unlimited	Unlimited
Accommodation Capacity	50-150	40-200	200-400	20-50
Day rates (USD thousands)	200-400	100-250	500-800	30-70
Weather environment	Harsh	Benign	Harsh	Limited Harsh

Table 1: Offshore Accommodation options other than using a flotel. Source: *Ocean Hotels Plc.*

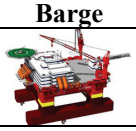
	Ship	**Mono-hull Barge**	**Semi-submersible Barge**	**Jack-up Barge**
				
Water depth	Unlimited	with DP: unlimited Moored: 300 m	with DP: unlimited Moored: 300 m	<120 m
Accommodation Capacity	400-600	400-1000	300-800	70-330
Day rates (USD thousands)	120-200	100-150	150-250	70-130
Weather environment	Benign	Benign	Harsh	Harsh

Table 2: Offshore Flotel (or accommodation vessel) types. Source: *Ocean Hotels Plc.* / Own elaboration

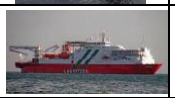
Name		**Owner**	**Description**	**Berths**	**Station-keeping**	**SOLAS type**	**Delivery**
Polycastle		Polycrest AS	Multipurpopse offshore flotel vessel	400	DP3	Special Purpose Ship	Second quarter of 2012
Edda Fides		Østensjø Group	Accommodation vessel with construction support	600	DP3	Special Purpose Ship	First quarter of 2011
Ice Maiden		Adams Offshore Ltd.	Ice Class DP3 Flotel	400	DP3	Passenger Ship	Delayed
Ocean Hotels		Ocean Hotels Plc.	Multipurpopse accommodation vessel	400	DP2 (DP3 retrofit)	Special Purpose Ship	Delayed
Dan Swift		J. Lauritzen Pte. Ltd.	Accommodation and Support Vessel (ASV)	291	DP2	Passenger Ship	Delivered November 2009
ARV 1		Equinox Offshore	Accommodation Repair Vessel (ARV)	523	DPII	Passenger Ship	Delivered end of 2010
ARV 2		Equinox Offshore	Accommodation Repair Vessel (ARV)	1122	DPII	Passenger Ship	Planned for 2011

Table 3: Offshore Flotel ships in operation and on order. (source: Ocean Hotels Plc. / authors own elaboration)

The flotel ship offers the following advantages compared to a semi-submersible flotel:

- A flotel ship is considerably cheaper to build and operate than a semi-submersible.
- A ship has considerably lower costs in moving from one site to another, and moves much faster.

But flotel ships present also one important disadvantage: a semi-submersible is more stable in motions than a mono-hull (ship-shaped) unit and is therefore more suitable for harsh environments. The problem of roll movement can be minimized for a ship with the installation of active anti-rolling systems, such us active tank anti-roll stabilizers. But the heave movement, the main cause of seasickness, cannot be avoided in a ship.

Apart from semi-submersibles and ships, mono-hull barges have also been used for many years to providing extra accommodation for the offshore industries, also offering other possibilities such us heavy lifting or pipelaying. They are normally non self-propelled mono-hull vessels and represent a low cost alternative in benign/intermediate waters.

An advantage is:

- Cheaper than the other types: semi-submersible and flotel ships.

Disadvantages are:

- Not self propelled. It needs tugs for movement.
- Only suitable for benign and shallow waters, as they are not normally provided with dynamic positioning (DP) systems, and should be anchored.

However recently, there has been an increasing number of projects of self-propelled barges (at low speeds) with DP systems, which means that they are becoming the preferred solution for many marine contractors.

In some cases, jack-up platforms are used as accommodation vessels, but these are limited to shallow waters of a few metres depth.

The following sections consider the four types of flotels:

- Section 4: Ships.
- Section 5: Mono-hull barges.
- Section 6: Semi-submersibles barges.
- Section 7: Jack-up barges.

We will see a representative example of each of the types.

4. OFFSHORE FLOTEL SHIPS

4.1 INTRODUCTION

As discussed, the use of ships as offshore flotels is quite recent, with *M/V Edda Fjord* being the first flotel ship with performance good enough to prompt several other projects since. During 2008 and 2009, the financial crisis and the decrease in oil price, have led to delays and even cancelations of some of these projects, but those still in development will begin operation in late 2010. Table 3 shows some of these projects. It can be seen that most of them are not pure accommodation vessels, but have other features, mainly related to offshore support and subsea construction. During the time where its service as a floating hotel is not required, the ship may be used for rapid transport of offshore personnel, in areas with which lack an established infrastructure, to or between rigs, vessels or ports. Some of them may also be used as offshore construction vessels (with a much lower capacity, of course) for subsea operations with the assistance of a remotely operated vehicle (ROV) or diving services. The large cargo deck would be used for storing of offshore equipment or used as a working deck for different offshore operations such as equipment overhauling. Therefore, they are outfitted and prepared for the following duties:

- Accommodation support.
- Hook-up, commissioning and start-up support.
- Maintenance support.
- Light construction work
- Crane operations.

Therefore, these ships are very versatile and are similar to any offshore construction vessel. The picture below from Ocean Hotels Plc illustrates quite clearly all of these ideas.

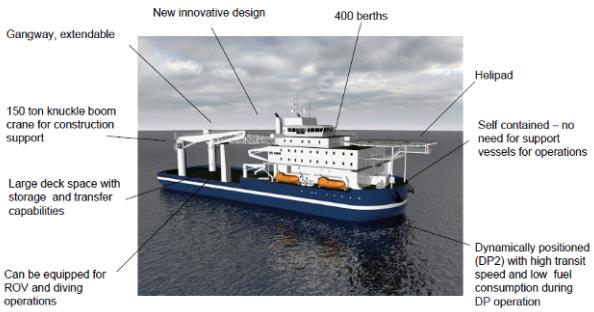


Figure 9: main duties in a flotel ship.
(source: Ocean Hotels Plc)

A flotel ship is normally tank tested to determine its ability to maintain position in DP mode and its suitability for personnel transfer in a variety of environments. Model tests should be used to evaluate passenger comfort (so-called MIR or Motion Illness Rating) in accordance with requirements for other passenger vessels related to vertical acceleration. In this

respect, these vessels are not only very well suited for operations in, for example, the Gulf of Mexico, West Africa and Southeast Asia, but also in areas exposed to inclement weather such as the North Sea, Canada and the northern part of the Pacific, although in these areas a semi-submersible flotel is preferred, as explained later on.

As per SOLAS and Class Societies, flotels may be of the passenger type or of the Special Purpose Ship type (SPS), as discussed in the following sections.

4.2 PASSENGER FLOTEL SHIPS

In Classification Societies and as per SOLAS rules, the application of the class notation *Passenger Ship* is limited to cruise and ferries ships, and it would not be possible to apply it to other structures such as barges, semi-submersibles or any other innovative structure, as they are not "ships". But the novel concept of flotel ships means that some of them are included in this category, as shown in table 3, and as in the following example.

4.2 (a) Dan Swift

The dynamically positioned Accommodation and Support Vessel *Dan Swift* was converted in 2009 from a former cable laying ship at Blohm + Voss Shipyards (Germany) by offshore contractor J. Lauritzen Singapore Pte. Ltd. It is designed to work adjacent to both fixed structures, platforms and floating units such as FPSOs and semi-submersibles.

Figure 10: Dan Swift.

Technical features:

Tonnage:	13,600 GT
Length:	149.50 m
Beam:	20.75 m
Draft:	7.8 m
Speed:	12 kn
Capacity:	291 berths in total with 256 passenger berths: four single cabins, 34 double cabins, 46 four-person cabins
Class:	DNV ✠1A1 Passenger Ship, E0, HELDK-SH, DYNPOS-AUTR, NAUT-OC, CLEAN, BWM-E(s), COMF-V(3)
Cost:	-

4.3 SPECIAL PURPOSE SHIP (SPS) FLOTEL

Special Purpose Ships (SPS) is the main class notation used for ships giving services to Offshore Oil Platforms, such us construction vessels, supply vessels, anchor handlers, etc. and including also Accommodation Support Vessels (Flotels). As the personnel on board these vessels, in spite of not being seamen, are quite experienced in working at sea, they are not considered passengers, but "special purpose" people. Some rules from passenger vessels are applied, sometimes along with some rules from cargo vessels.

Recently, IMO and some Classification Societies such as DNV have revised the definition of this category of Special Purpose Ships due to an increasing demand for sophisticated types of ships carrying personnel performing specialized work onboard. The new IMO *SPS Code 2008* and the DNV Class Notation *SPS* take into consideration the fact that many SOLAS provisions for cargo ships have been substantially improved since the first SPS Code was adopted. It is expected that this might, in some cases, simplify conversion of relatively new dry cargo ships into SPS ships in the future.

But in relation to accommodation vessels, there has been some controversy inside the Classification Societies about the use of the SPS category. In principle, the SPS Code should be a voluntary code and it is up to each administration to decide how it should be applied. When delegated by Flag, the Classification Society should follow the instruction from Flag with Statutory Certificates. However, the 2008 SPS Code clearly states that *"the code is not intended for ships used to transport and accommodate industrial personnel that are not working on board"*. Based on this, an accommodation vessel only operating with Cargo Ship Certificates supported with a SPS Certificate could run into problems with local authorities and future changes of flag. A Passenger Ship Safety Certificate or MODU Code Certificate would be better options for statutory certificates. An example is the case of *M/V ARV1* (Accommodation Repair Vessel) owned by Equinox Offshore, which was planned to be converted from an original ro-ro pax ship to a Special Purpose Ship, but will ultimately be delivered in late 2010 as a Ro-Ro passenger ship.

The following section is an example of a SPS flotel.

4.3 (a) Edda Accommodation

This is a Multipurpose Accommodation and Service Vessel owned by Østensjø Group, which has a long history in offshore services and is also the owner of *Edda Fjord*, the first flotel ship. The vessel, designed by Wärtsila Ship Design and being built at Barreras Shipyard (Spain), is to begin operation in the first quarter of 2011. It is equipped with the highest class of

dynamic positioning system (DP3), and 5 Voith Schneider propulsion systems.

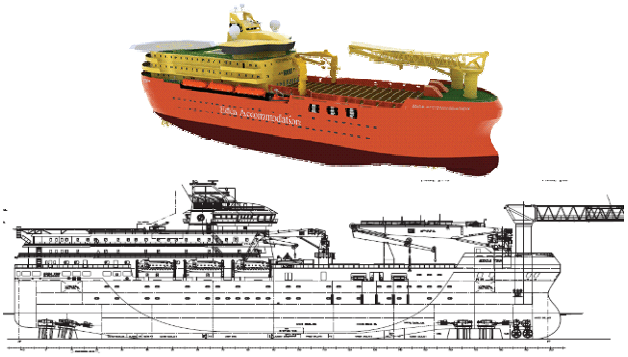


Figure 11: M/V Edda Accommodation

Technical features:

Length:	130 m
Beam:	27 m
Draft:	7.0 m
Speed:	12 kn
Capacity:	600 beds in total in 1, 2 & 4 bed cabins. A total of 177 cabins
Class:	DNV ✠1A1, SUPPLY VESSEL, SF, EO, ICE C, DYNPOSAUTRO, CLEAN DESIGN, COMF-V(3), COMF-C(3),NAUT AW
Note:	it has not the SPS Class Notation, but complies with the SPS IMO Code
Cost:	US$140 million

5. MONOHULL ACCOMMODATION WORK BARGES

5.1 INTRODUCTION

As per the definition of Det Norske Veritas (DNV), *"Barges and pontoons are defined as vessels without sufficient means of self propulsion for their service area. Assistance from another vessel during transit or transportation service is assumed. Guidance note: In vessels with limited means of self propulsion an upper limit for barges/pontoons may normally be taken as machinery output giving a maximum speed less than V = 3 + L/50 knots, L not to be taken greater than 200 m."* So barges could be self propelled but at very low speed. That means that even with thrusters for dynamic positioning a barge is still considered a barge and not a ship. When in service, they are normally moored or anchored to the bottom if not equipped with a DP system. They can be of the mono-hull type, of the semisubmersible type, or even of the jack-up type, but the term "barge" normally refers only to the mono-hull type.

Mono-hull Accommodation Work Barges (AWB), have been supporting the offshore oil and gas industry from the very beginning, even before the first semi-submersible flotel, but limited to benign and shallow waters, such as the Gulf of Mexico or West Africa. AWBs have traditionally been used wherever there is a need for additional accommodation, engineering, construction or storage capacity offshore.

AWBs can be positioned alongside installations, or in central locations where they act as field operation centres for maintenance of groups of platforms and structures.

As opposed to barges for coastal and inland waters (see the section on coastels), an offshore mono-hull barge must be:

- Long enough to have minimal pitch and surge response to the waves in which it normally works → typical offshore barges run from 80 to 160 m in length.
- Wide enough in beam to have minimum roll → width should be 1/3 to 1/5 of the length.
- Deep enough to have adequate bending strength against hog, sag, and torsion, as well as adequate freeboard → Depth will typically run from 1/15 of the length. Inland barges, subjected to minimal wave loading and required for operations in shallow water may have depths as low as 1/20 of the length.

Such ratios have been found to give a reasonably balanced structural performance under wave loading. In fact, the classification under which they are built is totally different. While coastel barges are classified as *Hotel Barge –RE Pontoon*, there is a dedicated notation for the offshore barges in most of the class societies: *Accommodation Work Barge*.

The following paragraphs give one example of each type of AWB: non-propelled and self-propelled.

5.2 NON-PROPELLED MONO-HULL BARGES

This is the most common type of Accommodation Work Barge, but is limited to operations in relatively shallow waters as it should be moored or anchored to the bottom. Although current mooring technology makes it possible to reach deep waters of up to 1,700 m, dynamic positioning is more effective at such depths. In practice, these moored barges are used in shallow waters of up to 300 m in depth.

5.2 (a) Lancelot

This is a typical Accommodation Work Barge owned by Intership Limited. It was built in 2009, with an 8 Point Mooring system and provides all the accommodation facilities for offshore workers and also has lifting capacity of 25 ton.

Figure 12: Lancelot Accommodation Work Barge

Technical features

Length:	111.56 m
Beam:	31.7 m
Draught:	4.50 m
Capacity:	300 men in single, double and four men cabins. Single berth: 8 x 1 berth; Double berth: 14 x 2 berth Four (4) men berth: 66 x 4 berth
Class:	ABS ✠A1 Accommodation Work Barge
Cost:	US$36 million

5.3 SELF-PROPELLED MONO-HULL BARGE

These vessels incorporate a propulsion system that is normally used for station keeping; therefore, it is more a DP system than a pure propulsion system for navigation. In this way, the barge can be used in unlimited depth waters, more than 300 m depth, the practical limit for moored barges.

5.3 (a) SAFECOM 1

This Accommodation Field Development Vessel (AFDV), owned by B-H Offshore, is very similar to the previous example, *AWB Lancelot*: also having an 8 Point Mooring system, all the accommodation facilities for offshore workers and a big lifting capacity. But apart from that, it has also some features typical of flotel ships: offshore gangway and a DP system consisting on 6 thrusters.

Figure 13: SAFECOM 1 - AFDV

Technical features

Length:	100.58 m
Beam:	31.70 m
Draught	4.50 m
Capacity:	400 beds in total: 1, 2 & 4 bed cabins. Total of 140 en suite cabins.
Class:	ABS ✠A1 Accommodation Work Barge DP2
Note:	Complies with latest editions of SOLAS & MARPOL; SPS & MODU code stability compliant.
Cost:	-

6. SEMI-SUBMERSIBLE ACCOMMODATION BARGES

6.1 INTRODUCTION

A semi-submersible barge is a specialized marine vessel with good stability and seakeeping characteristics. The semi-submersible type of vessel is commonly used in a number of specific offshore roles such as for offshore drilling rigs, safety vessels, oil production platforms, heavy lift cranes and also as accommodation vessels. The terms “semisubmersible”, “semi-sub” or just “semi” are also generally used for this type of vessel. Semi-submersibles are particularly well-suited to a number of offshore support vessel roles because of their good stability, large deck areas, and variable deck load (VDL).

In areas such as the northern North Sea, semisubmersibles are largely used for drilling construction and for floating production because of their ability to carry out their operations over extended periods without interruption due to weather downtime. This is possible due to the better performance in heave and righting moments with little effect of the waves on the barge motion. This lack of response to the typical wind-driven seas is due both to the relatively small change in gross buoyancy and to the much longer natural period of the vessel, especially in roll, pitch, and heave. Whereas the standard mono-hull barge has a natural period of 5-6 seconds, the typical semisubmersible barge has a natural period of 17-22 seconds. Nevertheless, there are three penalties to pay for this favourable performance:

- Semi-submersibles have much greater response to externally applied loads such as weights, loads, and ballast. Another way of stating this is to say that its righting moment and metacentric height are much lower than those of a standard mono-hull barge
  - the stability performance is worse than a mono-hull barge, and it is therefore impossible install as much in the way of living quarters or accommodation modules as in a mono-hull barge.
- The semi-submersible has seriously reduced topside cargo capacity. It relies on a low centre of gravity to maintain stability
  - This is related to the previous point and confirms that the mono-hull barges offer more capacity for installing living quarters.

- The semi-submersible costs more to build and to operate. Ballast controls are similar to those for a submarine
    - mono-hull barges are a cheaper option.

It could be concluded that for an accommodation vessel in medium and benign waters (up to 6 metre wave seas) a mono-hull barge is a better option than a semi-submersible barge. But in harsh environments, like the northern North Sea, semi-submersible barges are the preferred option.

6.2 CLASSIFICATION

Semi-submersible barges are normally not called "barges" as this term is widely used for mono-hull barges. Both in IMO and in Classification Societies, rules for mono-hull barges are included in rules for ships, while the semi-submersibles have separate rules. The IMO MODU Code is an accredited design and operational guideline for Mobile Offshore Drilling Units of the semi-submersible type. Classification Societies also have different standards for offshore structures and ships. Accommodation semi-submersible barges are normally included in the class notation *Column Stabilized Accommodation Unit*, similarly in DNV (*Recommended Practice DNV-RP-C103*) and ABS, that also should comply with IMO MODU Code. *Recommended Practice DNV-RP-C103* states*:*

"The methods outlined in this RP are mainly developed for the analyses of twin pontoon units and ring pontoon units. Consequently this should be taken into account when other concepts are considered. Ring pontoon designs normally have one continuous lower hull (pontoons and nodes) supporting 4-8 vertical columns. The vertical columns are supporting the upper hull (deck).

Twin pontoon designs normally have two lower hulls (pontoons), each supporting 2-4 vertical columns. The 4-8 vertical columns are supporting the upper hull (deck). In addition the unit may be strengthened with diagonal braces supporting the deck and horizontal braces connecting the pontoons or columns."

There are basically two ways of keeping the unit in position:
— mooring by anchor lines (passive mooring system)
— dynamic positioning by thrusters (active mooring system).

A combination of these methods may also be utilized. The units are normally designed to serve at least one of the following functions:
— production
— drilling
— accommodation
— special services (e.g. diving support vessel, general service, pipe laying vessel, etc.)."

Therefore, two types of accommodation semi-submersibles barges can be distinguished: DP and moored units. Examples of both types are given in the next paragraphs.

6.2 (a) Safe Scandinavia

Safe Scandinavia, owned by Prosafe AS and built in 1984, is an accommodation platform with a 12 point chain mooring system, allowing station keeping in the harshest of environments. It is also equipped with a transfer gangway and cranes.

Figure 14: Safe Scandinavia flotel

Technical features

Length:	106 m
Beam:	98 m
Draught:	Transit: 7m; Operation: 22m; Survival: 18m; (incl. Thrusters)
Capacity:	583 Persons Total and 59 workstations
Class:	DNV ✠1A1 Column Stabilized Unit, EO, Non-self-propelled, HELDK, SBM
Cost:	-

6.2 (b) Floatel Superior

Floatel Superior owned by Floatel International Ltd. is a flotel delivered in early 2010 and designed for operations in the North Sea including the Norwegian Continental Shelf, an area with some of the harshest environmental conditions in the world. It is equipped with offshore gangways for personnel transfer and positioning systems for unlimited water depth consisting on a DP3 positioning system and an 8 point mooring system.

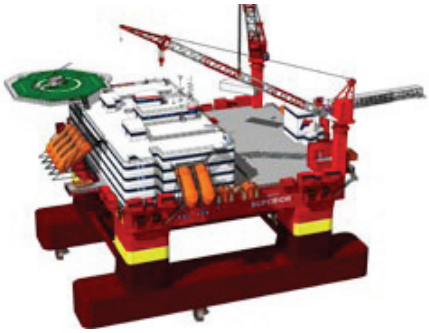


Figure 15: Floatel Superior

Technical features

Length:	94 m
Beam:	64.5 m
Draught:	Operation: 23 m; Survival: 18 m; Transist: 13.4 m; (incl.Thrusters)
Capacity:	440 bed accommodation, all single bed cabins, or 512 using double bed occupancy
Class:	DNV ✠1A1 Column Stabilized Accommodation Unit (N), HELDK, E0, DYNPOS AUTRO, POSMOOR V ATA , BIS
Cost:	US$316 million

7. JACK-UP ACCOMMODATION BARGES

7.1 INTRODUCTION

Jack-ups also include specialized barges that are similar to an oil and gas jack-up platform but are used as a base for servicing other structures such as offshore wind turbines, long bridges, and of course drilling platforms. One of those services is providing accommodation facilities as a flotel. There are not many units of this type, but one of them is described below.

7.1 (a) Safe Esbjerg

Safe Esbjerg, owned by Prosafe AS, is a triangular jack-up accommodation vessel capable of working in harsh environments in depths of up to 50m. It was converted from a drilling jack-up rig built in 1975 to an accommodation/service jack-up in 2005.

Figure 22: Safe Esberg jack-up

Technical features

Length:	62 m
Beam:	51 m
Draught:	4,25 m (operation)
Capacity:	139 Persons
Class:	DNV ✠1A1, SESU, MODU Code 2001
Cost:	- USDm

8. THE MARKET OF OFFSHORE FLOTELS

Offshore Flotels are broadly used in the latter part of an oilfield's lifecycle**, in bold** in following scheme:

→Seismic Survey
→ E&D drilling
→ Pre-engineering / concept studies
→ **Hook-up / commissioning**
→ **Operation & maintenance**
→ **Decommissioning**

Their use, in general, is a follows:

- 70% of its time providing assistance for the repair and maintenance of existing platforms.
- 20% for hook-up of new platforms and floating production units.
- 10% for decommissioning.

Flotels can also be used in other areas such as disaster recovery re-commissioning (from hurricane damage for example) and in subsea construction.

Before the financial crisis in 2008, it was expected a continuous demand for flotels as a direct consequence of growth in offshore developments. Reasons:

- High oil prices increasing demand to bring in new fields, develop marginal fields and extend the life of existing fields.
- The lack of online production capacity which was forcing oil and gas companies to find and produce new fields.
- Increasing repair and maintenance work on a growing number of installations in operation.
- Older fleet (average of 20 years).
- New HSE and regulatory requirements.

After a slowdown in all the offshore sector during the period from late 2008 to 2009, the accommodation market seems to be recovered and has steadily improved since January 2010. There was a general freeze on projects by major oil companies and subcontractors throughout 2008 and 2009 due to (i) low oil prices which resulted in new projects being uneconomical; and (ii) the inability to secure debt financing which forced companies to delay (or delay and then cancel) installation, hook up, commissioning, repair and maintenance programs, which is the work where the flotels are ideally intended for. In addition, during the economic crisis, the number and type of vessels bidding for accommodation projects increased as the amount of offshore construction projects waned. This had the effect of temporarily increasing the competition in the industry.

The market is segmented as follows (Ref, 10):

- Semisubs: 20 units in total, with average age of 25 years.
- Barges. ~100 units in total and ~45 with accommodation capacity exceeding 250 PAX.

- Jack-ups: Between 20-30 units depending upon specification (many very old units).
- Ships: only a few units are expected in the short term. See Table 3.

Increased activity in new deepwater developments will require dynamically positioned accommodation support. Dynamic positioning is the best option for station keeping for waters over 300 m in depth. Therefore, the majority of mono-hull and semisubmersible flotels in production are equipped with DP systems, and some of the existing units are even being retrofitted with them.

9. CONCLUSIONS

We have seen through the paper how a wide variety of marine structures are used as accommodation vessels or flotels: from pontoons to jack-ups, from passenger ships to semisubmersible barges. In choosing the most suitable floating structure the location where it is intended to operate, depth and meteocean conditions (waves, wind and current) are the main parameters to have in mind. So there is not a single solution to providing floating accommodation, but several.

At the same time that the oil & gas industry is going to deeper and deeper waters, the offshore wind industry seems to be the next one that will require offshore flotels, but certainly with specific requirements different from those in oil and gas; so new concepts of offshore flotels are expected. The *CSS Accommodator* shown below is an example of this emerging market for offshore accommodation.

Figure 23: CSS Accommodator.
(source: Marine Asset Corporation)

As the 21st century will be the age of ocean colonization, mainly using the ocean renewable energies, it is expected that it will be also the age of floating accommodation. Going a step further, combining floating accommodation with ocean resources exploitation, perhaps this century will see the first floating cities, like the *Green Float*, the Botanical City Concept from Shimizu Corporation.

Figure 24: *Green Float*. Source: Shimizu Corporation

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