THE DEVELOPMENT OF THE OFFSHORE SUPPORT VESSEL

Question B.6.3 of the State Aid Guidelines review questionnaire

Abstract

The development of vessels in the offshore industry is reviewed. This has been driven by the growth of the oil and gas sector and controlled by changing economic circumstances during the latter half of the 20th century, as well as the last decade. It is demonstrated that a return to multi-purpose vessels to cater for the industry’s various needs is being seen after a late 20th century period of specialisation. Based upon the factors underlying this change and the likely needs of emerging offshore energy industries, especially offshore renewables, it is forecast that further growth of vessels’ capabilities will take place in years to come, with multi-purpose ships continuing to grow in popularity and become the established norm.

1 Introduction

Types of ships engaged in the offshore industry have grown in number, from Platform Supply Vessels (PSVs) and Anchor Handling Tug Supply (AHTS) vessels to include standby vessels, Emergency Response and Rescue Vessels (ERRVs) and a variety of construction and maintenance craft including Field Support Vessels, Inspection Maintenance and Repair vessels and Multi-purpose Support Vessels (MPSVs). The evolution of these ship types has been driven by the changing demands of the offshore industry’s platforms and activities, but also by economic pressures and the cost of fuel. Reversing the trend of the industry’s early years, in more recent times there has been an increasing tendency to combine these roles into truly multi-purpose ships. A list of acronyms and initialisms may be found in section 10.

2 Origins

Although it could be said that drilling over water had commenced as early as 1910 on Lake Catto in Quebec, serious ship development began in 1947 when Kerr-McGee purchased a surplus Landing Ship Tank (LST) to support their Ship Shoal platform close to the shore in the Gulf of Mexico and in 1948, Humble Oil purchased 19 of these ships to support their offshore operations. These vessels were provided with an open deck ahead of the pilot house, but had limited space between the wing tanks and restricted view from the pilot house.

Arguably the first supply vessel, the Ebb Tide (figure 2.1), was commissioned in 1955 to support the Mr Charlie Mobile Offshore Drilling Unit (MODU). This followed the mobile drilling unit’s appearance in its earliest form in 1950 as the Breton 20. The Mr Charlie and Ebb Tide were commissioned by Alden J (Doc) Laborde, who had been a superintendent for Kerr-McGee. The Ebb Tide was characterised by the position of the accommodation and the pilot house at the bow, leaving the aft deck largely free of encumbrances apart from her funnels. The ship had a deck area of 90 by 27 feet. This design allowed drilling tubulars to be loaded and unloaded.

Figure 2.1: Tidewater’s Ebb Tide, the origin of the modern OSV form
easily to and from the deck alongside a platform. Other operators commissioned further ships based on the *Ebb Tide* and Doc Laborde left Odeco to form Tidewater.

The next major change in the offshore industry was the arrival of the three legged jack-up, the first being the *Scorpion* which entered service in 1956. Supply vessels now faced a reduction in the area of the platform at sea level, being reduced to its legs. It became necessary for them to drop an anchor and tie up stern-to, in what was known in the manuals of seamanship as a “Mediterranean Moor”, presenting their aft decks to the platform. In 1960, the first semi-submersible platform was developed. This was the *Bluewater One*, which had originally been a submersible, sunk until the lower hull rested on the seabed, but was modified so that it could remain afloat at a draught which provided a stable drilling platform.

### 3 Development of the offshore industry

Developments in the drilling business were enabled by the development of the support vessel. By 1960, Tidewater and others had a number of supply vessels in operation, but these were solely involved in cargo carrying operations, with routine supplies and drilling equipment being transported. Tugs were used to move platforms and deploy their anchors, a difficult task.

During the 1960’s, it was realised in America that the supply vessel could also act as a mooring vessel by the addition of a winch at the forward end of the deck and an A-Frame aft which allowed anchors to be deployed and recovered. These vessels could be considered to be the first multi-role support vessels or anchor handlers. It should be noted that at this time the use of under-deck tankage was limited to fuel, fresh water and drill water; the only difference between the two types of water being the quality of the tanks used.

By the mid 1960’s, the oil boom began in the North Sea. Two American Jack-ups, the *Mr Cap* and the *Mr Louise*, and the BP rig *Sea Gem* started work, serviced by a number of American supply vessels and a few tugs. Some of the numerous British ship-owners of the time invested in this new activity. The Germans and the Dutch also became involved, and the Dutch tug owners Smit-Lloyd were particularly active. Naturally, all these parties identified differences, especially environmentally, in the North Sea from elsewhere in the world that the offshore oil industry had up to that time been working; it was clear that different types of vessel were required.

### 4 Evolution of offshore vessels

The Smit-Lloyd 1, the first Smit-Lloyd supply vessel which entered service in 1965, had funnels placed just aft of the pilot house, removing from the aft deck the most significant encumbrances remaining in previous designs. She also sported a winch fitted aft of the accommodation and a roller for the deployment and recovery of anchors.

In the early 1970’s, Ocean Inchcape (OIL), entered the fray. To begin with, all of their tonnage were focused on anchor-handling rather than the primary supply role of their predecessors, with about 2980 KW available and a deck area of 372 m². However, they also retained underdeck carrying capacity for dry bulk, such as cement, barite and bentonite, as well as fuel, drill water and potable water. With these versatile ships available, it became common for operators to hire a rig and assign anchor-handlers to it. These ships would fulfill the complete support process. They would tow the rig to the location and anchor it, then supply the drilling equipment from the shore and, once the drilling operation was taking place, provide the day-to-day supply requirements of the MODU; including containers, baskets, tubulars, fuel, water and bulk cargoes.
By the mid 1970’s, fixed platforms were being built throughout the North Sea. In 1974, the Forties Field jackets were put in place and in 1975, the first oil from the North Sea was produced by Hamilton Brothers from the converted semi-submersible Transworld 58 on the Argyll Field. Anticipating this development, operators introduced dedicated supply ships into their fleets. Without towing capability, these were less expensive to construct and operate and were therefore attractive to the operators of established platforms. The Norwegian owned but British managed Bugge Supply Ships introduced a whole class of what were then large dedicated supply ships, and Star Offshore purchased the Star Aries and Star Pegasus, considered at the time to be enormous vessels. These ships were generally assigned to platform construction, while the anchor-handlers continued to support mobile units.

It also became evident by the middle of the decade that there would be a requirement for pipe-carriers. Star Offshore entered this market and Offshore Supply Association (OSA) built numerous small ships capable of carrying two lengths of pipe. In Norway, Ulstein designed and built the UT 705, a large ship capable of carrying three lengths of pipe. However, its length was still able to fit in between the anchor chains of the pipe laying barges. The arrival of this ship in the North Sea, and the fact that many of the platforms under construction were not provided with mooring ropes, probably changed the process of working cargo alongside offshore installations.

It had been almost universally accepted that the technique for working cargo was to drop an anchor at a distance from the rig, run in bow first until the ship was very close, and then turn and tie up with a rope at each quarter. The crane of mobile units was usually able to reach about half way along the supply ship's deck, which resulted in the cargo being moved aft during discharge and forward during loading with tugger winches. In order to assist with this task, OIL produced two vessels with a hydraulic deck which could be moved aft once the stern area was clear, and the American company Zapata introduced two large dedicated supply ships which were similarly equipped. If the weather was too rough to tie up, and if the requirement for cargo was urgent, the Master might be asked if he could “snatch” it. This involved positioning the stern of the ship under the crane without tying up, and holding it there for as long as it took for the crew to hook on the lift. Where platforms did not have any ropes installed, it became necessary for whole cargoes to be snatched, and eventually for bulk cargoes to be discharged with long hoses. Hence, with the advent of underwater side thrusters, instead of the ship lying stern-to the rig, it could be aligned alongside; making the whole deck available to the crane. This realignment of the ship made it possible for the pipe-carriers to become cargo carriers, and they could carry such large quantities of cargo that they began to be used to support several locations at the same time. It may be at this time that the concept of the PSV came to be. However, the industry had not abandoned the possibility that cargoes would also be carried on anchor-handlers, and several operators continued with the traditional technique of hiring a rig and anchor-handlers which would form support throughout the operation.

In the late 1970’s, there were several other types of support vessel. These included submarine support vessels which carried one or two mini-submarines deployed at sea to carry out work on the seabed, either to operate with manipulators or to deliver divers to the site. There were also numerous diving ships engaged in deploying diving bells to make pipe connections, install valves and the like, and also some Remotely Operated Vehicle (ROV) support ships which were at that time mostly retired trawlers with limited Dynamic Positioning (DP) capability and used solely for pipe inspections.

### 5 Late 20th century ship types

By the mid 1980’s, the North Sea was becoming a mature area of oil production and exploration was taking place in deeper and deeper waters. This, and the fact that engine builders were finding ways of extracting more and more power from medium speed diesels, resulted in anchor-handlers being constructed...
with greater capability, but consequently higher fuel consumption. While these were claimed to have up to 13400 KW available, what were now being known as platform ships could manage with as little as 3730 KW for the same or greater cargo carrying capacity. This made platform ships not only cheaper to construct, but also significantly more economical to operate. However, in 1986 the oil price plunged to $9 a barrel which substantially stifled design and construction for a number of years. It also kept the most economical ships working, and the existing support vessels vied with each other for fuel economy.

By the beginning of the 1990’s, Ulstein were developing the replacement for the UT 705: the UT 745, which had a similar hull form but was provided with greatly increased thruster power and larger deck area, enabling work in more inclement weather. Other designers also produced new ships which included the Vik Sandvik VS 483, numbers of which were built in the UK. Ulstein, fulfilling the requirements of Gulf Offshore, produced the UT 755.

The third vessel of this type, the Highland Rover (figure 5.2), was a PSV with a moonpool and DP capability, with the intention that the ship be able to carry out survey work in addition to its primary purpose of carrying cargo and personnel. Sealion, which had been a late arrival on the North Sea offshore scene, and had until this stage only been an operator of dedicated supply ships, brought into service their own design of platform ship. Built at Appledore in Devon, they were the Toisa Coral and the Toisa Crest (figure 5.1), these ships could also function as cargo carriers or survey ships, capable of deploying an ROV. They have a deck area of 688 m², and extensive underdeck capacities including 1000 T of fuel; their combined sideways thruster power is 2380 KW.

It should be borne in mind that as the ships servicing the offshore industry have developed, so have the capabilities of the ROV. ROVs have been increasingly used during the development of oilfields and were beginning to replace divers in the 1990’s. Work class ROVs could tighten up nuts and bolts, turn valves...
and much more, particularly as subsea equipment began to be designed with ROVs in mind. Some owners began to seek further employment for their vessels provided with DP capability by making them able to carry out alternative tasks. AHTS were often being provided with ROV capability as well, sometimes in order to support the mooring operations which they were carrying out.

6 The re-emergence of multi-role ships

By the middle of the first decade of the new century, it had become the norm in the North Sea for operators to hire anchor-handlers for rig moves and to use the more economical PSVs in other roles. This under-utilisation of anchor handlers led owners to add additional features so that they could perform supplemental roles. Typically, the 2000-built Maersk Assister (figure 6.1) has over 14900 KW available, and a winch capable of 590 T loads with a wire capacity of 17000 m of 84 mm wire, but in addition a deck area of 800 m$^2$ and bulk capacities of 1100 T of fuel, 660 T of potable water and 600 m$^3$ of oil-based drilling mud. This class of ship can also be provided with an A-frame for subsea equipment installation.

In a similar manner, some owners who operate PSVs have expanded their range of activities to provide for employment in different environments. The developments of all these types of vessel have been made easier by the availability of more powerful prime-movers, the increase in thruster power and the now almost universal employment of DP systems.

A typical design which might be termed an MPSV is the Ulstein P103. By the turn of the century, Ulstein had sold off the UT brand to Vickers, which was then purchased by Rolls-Royce. In 2002, Ulstein re-entered the market with their own designs which were prefixed “Ulstein”. The Ulstein P103 has a deck area of 765 m$^2$ and can carry 1200 m$^3$ of fuel, 800 m$^3$ water and 700 m$^3$ of liquid drilling mud. It has 10400 KW available, about 6000 of which can be directed sideways. An example owned by Solstad has a 100 T crane, two work class ROVs and accommodation for 69 people. The owners of these ships generally consider that the crane will not obstruct cargo operations because they can operate in DP mode using as much of their very large power availability as necessary to maintain station precisely.

7 Wider operations

This document has concentrated on activities in the North Sea, and the designs which have resulted from these activities. Until the mid 1990’s, there was little development of offshore vessel types elsewhere in the world. Thereafter, designers and builders of support vessels worldwide have been using European experience to develop and employ their craft. After the Macondo disaster in the Gulf of Mexico during 2010, most of the ships employed by BP in response roles were European owned and built. Indeed, efforts by the American government to tighten the Jones Act, to prevent these vessels from operating, have been resisted by an industry which believes European marine expertise to be critical to the continuation of the business.
Until today, almost every vessel in the industry has been an extension of the principle developed in 1955 of a ship which had the pilot house and accommodation on the bow. The spread of capabilities of vessels, meanwhile, first narrowed and then, in more recent years, widened again. The aft deck of a support vessel of any type is often termed “the working deck” and provides a work platform on which cargo can be placed or, alternatively, which can be used for anchor-work or to support a crane for surface or subsea operations. Ulstein have recently designed a hull intended to carry a number of wind turbines, and of course many existing craft could be used to support wind turbine installation in various ways. There is also little doubt that those engaged in the attempts to harness the power of tides and currents will find it necessary to use both the ships and the marine expertise developed for the oil industry.

8 The Fleet in 2012

Now, in the second decade of the twenty-first century, offshore activity is becoming increasingly diverse. In addition to the basic tasks of supplying platforms and towing and anchoring rigs, there are now ships engaged in all forms of surface and subsea construction; many over 100 m long and with 14900 KW available and a crane capable of 250 T loads permanently mounted on the aft-deck. There are now also vessels in service capable of well intervention, which can maintain station at a well site and carrying out down-hole maintenance; a task which formerly required the services of a semi submersible platform.

What are often termed “anchor-handlers” can be capable of 350 T bollard pull. Some of these ships may never work with an anchor, being chartered in the long term to pull ploughs along the seabed in preparation for cable laying. Some ship-owners including Fairmount, a French company, and Harms Bergung, a German company, have resurrected the concept of the Anchor Handling Tug (AHT), a typical example being the _Uranus_ built in 2009, which is 74 m long and has a bollard pull of 280 T. ERRV have also become multi-role, probably the best known being the BP “Jigsaw” ships which are extremely large vessels with considerable cargo carrying capability in addition to their ERRV role, and the ability to deploy large daughter craft which are themselves “places of safety” and can operate independently for 24 hours even in adverse weather. Other ships are capable of carrying out ROV survey work and inter-field cargo transfers. There are also a number of 1980’s built platform ships which have been converted and, in addition to supply operations, can perform an emergency role.

9 Conclusion

The modern offshore energy industries require an increasingly diverse portfolio of services, almost all of them being fulfilled by what we would call Offshore Support Vessels (OSVs) and these vessels are all based on the experience gained in the North Sea and the UK Atlantic margin, wherever they are designed and built. Their designs allow increasingly for multi-role operation and the capabilities of these vessels are such that they are used across many marine sectors, some outside the energy business. Their success as a ship type can be traced to experience in the design field and the adaptation of designs over time, as well as expertise in their management and the skill and courage required to operate them.
10 List of acronyms and initialisms

AHT Anchor Handling Tug
AHTS Anchor Handling Tug Supply
DP Dynamic Positioning
ERRV Emergency Response and Rescue Vessel
LST Landing Ship Tank
MODU Mobile Offshore Drilling Unit
MPSV Multi-purpose Support Vessel
OIL Ocean Inchcape
OSA Offshore Supply Association
OSV Offshore Support Vessel
PSV Platform Supply Vessel
ROV Remotely Operated Vehicle

11 Glossary

A-frame: a gantry at the stern of a ship which can usually be rotated about its base, so moving its top inboard and outboard, allowing the transfer of equipment from the deck into the water and vice-versa.

Basket: an open container used for transport of loose materials.

Down-hole (activity): an activity taking place within the well itself.

Drill string: a column of drill pipe that transmits drilling fluid and torque to the drill bit.

Jack-up: a type of mobile offshore unit which, when on station, is elevated by lowering legs to the sea bed and then raising itself on them from the water's surface.

Mediterranean moor: the practice of securing a vessel stern-to the object which she is coming alongside, with anchors and/or mooring lines fore and aft to hold her in position.

Pipe laying barge: a moving barge, controlled by anchors or dynamic positioning, which carries out a pipe-laying operation.

Moonpool: an opening through the hull of a ship which allows for the lowering of equipment and/or machinery into the water.

Pilot house: the position from which a vessel is controlled when under way, usually located on, or in some cases synonymous with, the bridge.

Plough: a mechanical device attached to a vessel for laying, servicing and/or recovering pipes and cables within the seabed.

Tubular: a term describing pieces of drilling equipment or infrastructure of tubular form, normally well casing, pipe sections or lengths of the drill string itself.