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Logistic Supply on Offshore Drilling and Production Installation

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Abstract: The paper discusses the elements of logistic protection of works carried out on offshore and production (units) platforms. The article presents a system of supplying cargoes to off-shore units, which is provided to ensure safe operation of the system during daily operation and in an emergency situations. The logistics system for this type of units is a complex process involving, the 24/7 service personnel including specialists, delivers of cargo and standby offshore vessels which can deliver cargoes in variable weather conditions on time. The main aim of it is to obtain constant production and operation of the units and ensuring the safety of the crew, the environment and the protection of property.

Key words: cargo handling operation, offshore industry, logistic supply, offshore vessels.

1. Introduction

Oil and gas are referred as strategic resources because of their great importance for the proper functioning of economy in the world. Energetic resources are valuable resource for many industries because of their high energy value. Moreover, the still increasing population and progressive industrialization are causing a steady increase in demand on them. Any disturbance in the supply of raw materials can cause destabilization and economic crisis in a given region. To ensure energy safety in the world is a strategic activity of every country. To meet the requirement of the energetic market this process must be complex and include a wide spectrum of activity such as: conducting research of seabed structure, conducting drill and production works, ensuring suitable organization of work, preparing to do the wide spectrum of work and issuing suitable permission.

The largest group of the vessels that working in off-shore industry are Platform Supply Vessel PSV. They can carry a variety of cargoes on their board to and off the installation together with personnel/ services aboard. They can also be equipped with facilities to carry out a variety of explorations of the seabed structure and done a variety operation according to needs or requirements of the operator of the oil field.

The purpose/ of this article is to codify the elements of logistics systems functioning to ensure the safe operation of the marine installations and keep the continuity of production.

2. Working Offshore Infrastructure Industry

It needs to be highlighted that, the production of energetic resources from the seabed is one of the most complicated method of obtaining it, because of the location of the sources. This has contributed to the construction of highly specialized units which are equipped with innovation facilities that can be operated under adverse sea and weather conditions, at great depths, at variable pressure, temperature and other adverse factors. This has also led to the need to provide adequate conditions for the organization of work in the designated maritime area so as to make full use of the resources in the seabed and adapt to external environment and to

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prepare for any emergency situation.

For this purpose it is necessary to ensure coordination between the shore base and the marine oil field by keeping suitable organizational structure on shore which can react in any emergency situations (that's means: personnel crisis and technical department, mining rescue teams, vessel off- shore logistical support , shore base equipped with cargo handling facilities, cranes, warehouses, storage places and other infrastructure which is needed to ensure operation drilling and production units located Nautical miles away from shore.

2.1 Off-shore Infrastructure

The development of exploration and production in the marine areas has contributed
to the construction of different types of units, adapted to off-shore industry. New solutions in construction and equipment have resulted in the production of specialized units - vessel, sea platforms and installations prepared for specific tasks in the oil field located in the marine area. Depending on the stage of work organization in the field operation, suitable marine units are incorporated. Figure 1 presents a set of main types of infrastructure working in offshore mines.

With regard to the subject of the article, vessels operating for offshore drilling and extraction units will be presented in order to keep the continuity of the work by supply of regularly provided required loads. Nowadays offshore fleet represents over 10%[1] of the all world`s fleet. [2]

2.2 Offshore Vessels

At present, a group of offshore vessels are specially designed to support the logistic of offshore mine to ensure the continuous of exploitation of oil fields situated in the sea areas carrying cargoes and workforce.

Without off-shore vessels, it would not be possible to operate installations (platforms) located many Nautical miles from shore. Off-shore mines may be self-sufficient only for a maximum several weeks, and also in any emergency situations need to be serviced as soon as possible to protect environment form pollution, give help to personnel injured and protect construction of the installation from damage for example during a fire or explosion supplies of water from their extinguishing appliances must be available. The scope of work performed by the offshore vessels on the field of operation extends from:

- Performing research works on seabed structures.
- Conducting and supporting underwater operations with divers and submarine vehicles.
- Laying pipelines and submarine cables.
- Doing underwater and on the sea level constructions.
- Supply: equipment, delivers, devices, materials for installations in the oil field.
- Towing and anchoring operations.
- Maintenance off-shore infrastructure, inventory, assist during different kinds of operations (Fig.3).
- Doing rescue and stand-by operations.
- Transportation of personnel/services from and to installations .
- Other activity depending on needs.

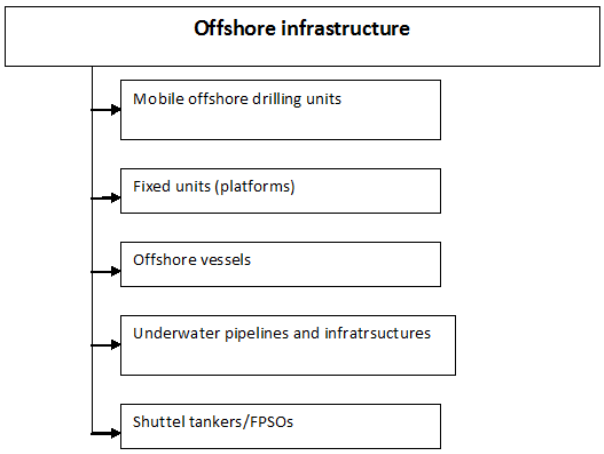


Fig. 1 Fixed and floating infrastructure used in off-shore marine industry.
Sources: Own study

[1] Crisis in offshore industry due to the low barrel of oil cost cause that number of offshore vessels do not operate in the open sea and are waiting for employment.

[2] J. Cydejko, J. Puchalski, G. Rutkowski, wydawnictwo cytowane, str. 72.

Fig. 3 Maintenance off-shore infrastructure - Catenary Anchor Leg Mooring CALM buoy by the AHTS vessels
Source: Own study.

2.2.2 Types of the Offshore vessels

The author of this article concentrate on the offshore vessel which are responsible for ensuring supply and support on the sea platforms, vessels and other units which are located in the oil field of logistics. Offshore vessels are specially designed to transport variety type of goods to and from off-shore infrastructure. There are, in addition to providing loads, can perform functions, such as: surveillance service areas, rescue (in the event of an man overboard alarm – equipped with life fast rescue boats which can take survivals after launching), treatment of spills (equipped with gatherers, mats, sorbents and pneumatic damps to prevent the spread of oil spills) or prevention of fire (equipped with fire extinguishers facilities, water cannons, sprinkler system).

The most popular vessel are Platform Supply Vessel - PSV. An example of a PSV vessel is shown in Figure 4. The length of such vessel ranges from 50 to 100 m, equipped with Dynamic Positioning Systems DP-1/DP-2/DP-3.

The supply vessel are specially designed to allow for the transport of various type of cargoes at the one time, which are stowed under deck and / or on deck as well. Under the deck are tankers for the transport of a variety type of liquid cargoes: fresh and technical water, fuel, drilling rigs and various chemical substances, as well as loose cargoes used to prepare drilling rigs on platforms such as barite or bentonite or other materials.

The deck in the aft is open and provides a cargo space on which containers, pipes, palletized goods, oversized cargoes, heavy lift devices (in accordance with ship safety conditions), dangerous goods, devices and other inquire cargoes can be carried. Loading space is protected on the both sides by cash barriers that protect the sides from damage during handling operations as well as changing position of them during sea transport.

Fig. 4 Platform Supply Vessel.
Sources: http://www.fearnleyoffshoresupply.com.

In order to protect cargo movement, aft in the loading space is covered with wood that reduces friction of cargo. The cargo prior to transport is properly placed to prevent it from moving during transportation and fixed if required. In addition, the vessel is specially designed by a high bow on which the superstructure is located. This provides excellent visibility in the 360º range. This is particularly important during approaching vessel`s stern to the installation and cargo handling operations. They are equipped with advanced propulsion systems and also dynamic positioning system to achieve millimeter precision and keep the position during operation close to the installation.

Mentioned groups of the vessels which are showed in the Figure no 4 can also perform other task than primary purpose (support) such as: offshore supply vessels can do rescue and assist stand-by, participate in rescue operations and provide assistance to survivals. Furthermore, they can equipped with suitable facility and maintenance underwater constructions of installations or other infrastructure located in the oil field, specialized operations such as chemical stamping to increase efficiency of the sources, setting up mooring and research buoys, doing underwater submarine operations with using underwater vehicle (ROV) and other wide spectrum of works which depending on operator requirements. Their ability to do variety range of works is especially important for economic reasons, such as: supply vessel after unloading remain on the oil field and can ready to start other demanding activities.

3. Rules of Supply of Drilling and Production Installations

The rules for the transport of cargoes to and from marine installations are set out in the operating instructions of the vessels and platforms as well as in the documentations on the shore cargo handling base. Cargo transportation can be done in the relation installation - shore, shore- installation and installation – installation which are located in the open sea.

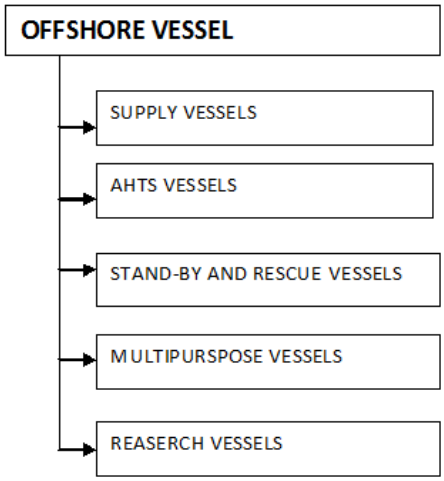


Fig. 4 The most common types of the off-shore vessels.
Sources: Own study.

These operations are well planned and coordinated to prevent interruptions in the operation of the installation with due to lack of required delivery. Shortages in supplying of the required cargo could lead to stop at working (downtime) and this would generate additional economic costs. Nowadays, when it is a crisis in the offshore industry no one in the off-shore industry can not afford it any undesired interruptions and ensure continue smoothly operations.

Due to the fact that support and supply are a significant part of the cost of producing energy. Offshore company and co-operatives increasingly focus on the optimization of maritime logistics. At present looking for optimal supply vessel and focuses on the logistics design system to make it as efficient as possible. This is should be understood as the use of vessel that generate low operating costs, is a multipurpose units delivering manpower and technical reinforcement ensuring the proper organization of sea transport so that there will not be “empty” carriage with an unused cargo space. For this purpose to ensure suitable and organization of carriage before departure of the vessel should be done in this mean: verified orders, particularly agreed supply voyages, economic fuel consumption, keep standby of the vessel and flexible to change the operations, etc.

Fig. 5 Offshore supply vessel during cargo handling operation in the energetic resources B-8 in the Polish EEZ.

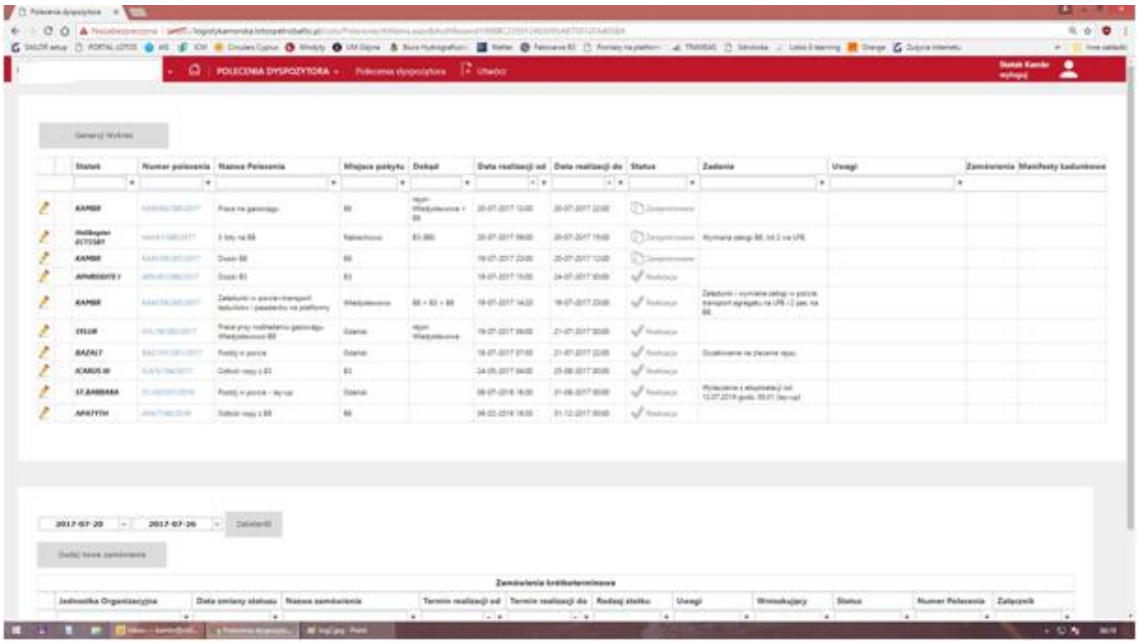


Fig. 6 Preen screen marine logistic system with timetable delivery

Sources: LPB

3.2 The Example of Functioning Logistic System

Cargo order can be prepared in an email from the requester to the person performing the order or input cargo details into the maritime logistics order system (Fig.6) that is accessible to everyone involved in the cargo handling operations and sea transport.

For this purpose there are designated coordinators who are 24 hours in service 7 days a week, who provide:

1. Current receipt of cargo demand informatio
2. Organization of transport.
3. Management given order.
4. Reading the cargo requirements of materials from the maritime logistic system.
5. Generate cargo manifests based on the information from the maritime logistic system.
6. Cooperate with shore personnel responsible for: cargo handling operations, sea transport (carriage cargo by sea) and unloading at the place of destination.
7. Indicate prioritize the carriage of cargo.
8. Incorporated changing into the system according

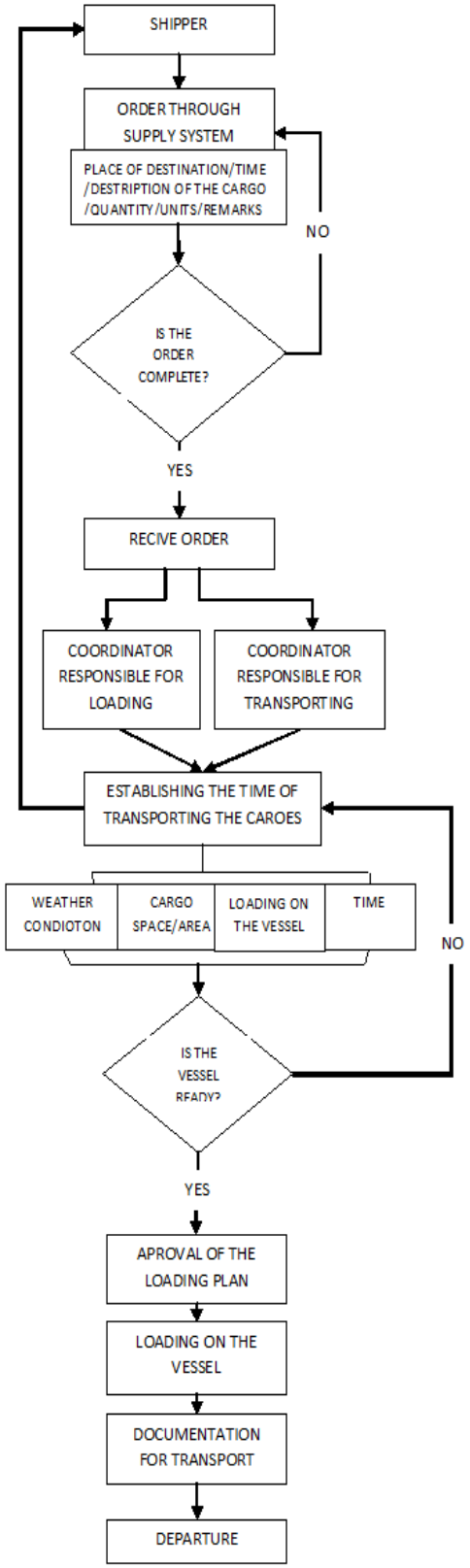
to theirs permission and make changes to cargo manifests.

One of the party in the cargo supply process is the shipper who notifies the needs for transport and is responsible for monitoring the cargo operation (cargo handling and sea transport) such as: what is the cargo status, when the cargo will be loaded, when the cargo reaches the place of destination and is the cargo in the place of destination and can introduction any corrections to the declared need for transport. An example of a functioning logistics system is shown in Figure 7 and in the following points.

The person managing the cargo or ordering the selected cargoes (Shipper) enter order into the marine logistic system together with cargo characteristics and describe the transport priority (urgency).

On the installation through the easy access to the order database (maritime logistic system), person who is responsible for receiving the deliver can constantly monitor the status of the cargo, where is the cargo, when it will be transported and if there are any delays or any remarks.

The final confirmation of the cargo loaded onto the supply vessel is made up of a cargo manifest. The cargo manifest contains a list of actual cargo loaded onto the ship and number of Bill of Lading. Bill of Lading is a valuable paper. It is proof of carriage of cargo. The person, on the basis of the bill of lading, can pick up the goods at the place of destination. A document issued by a carrier or agent to the shipper is regarded as a contract of carriage of goods. It is also a receipt for cargo accepted for transportation [http://www.businessdictionary.com/definition/bill-of-lading-B-L.html]. The cargo manifests are prepared in a paper for every places of destination. Every single cargo manifest has an individual number for every place of destination, including: number/installation name/date of issue. A complete cargo manifest is also included in the logistic system documentation.



Rys. 7 Schematic diagram of cargo transport documentations.
Source: Own study

Functioning of the marine logistics system (portal) is based on an electronic process. The entered record in the system is the order to load the cargo. Starting the loading the cargo takes place after agreement cargo handling operation between the shore base coordinator and the master of the vessel. The loading takes place on the basis of the declared cargoes placed on the maritime logistics portal.

Any changes in the loading are kept currently between the coordinators and entered into the marine logistics portal. In order to change the type of cargo, the cargo carrier introduces them to the system and inform coordinator by phone about implemented changing.

The supply vessel has access to the information contained in the system and therefore, in addition to information from the coordinator, so is aware of the type and quantity of planned loading cargoes on the vessel. The vessel may refuse to load the cargo on deck, in this case the master introduced a comment on a given cargo into the marine logistic system and inform coordination about the situation.

3.3 Disruptions in Delivery

A standard procedure may be unreliable when the following situations occur:

- There is no possibility of loading by the shore base.
- There is no possibility of discharging (unloading) the supply vessel at the installation.
- There was a cargo nonconformities with the cargo manifest.
- There was adverse weather conditions.
- There was vessel accident.
- There was accident on board
- The vessel need to change the route
- There was cargo damage during cargo handling operation.
- There was cargo damage during voyage.
- There was damage during unloading from vessel to installation.

If there is no possibility of loading cargo on the vessel, this situation is recorded in the marine logistic system together with giving the reason and informing shipper.

In the event that there is no possibility of unloading the supply vessel for installation due to weather conditions or other technical factors, the cargo with the cargo manifest remains on the vessel until the explain of the cause or return to the base. The master must make an appropriate record on the cargo manifest which it transmits to the platform and a copy is left in his documents. The person responsible for receive the cargo on the installation shall record in the cargo manifest on referring to the lack of cargo on the platform.

If there is a nonconformities of the cargo with the cargo manifest the cargo is refused (not accepted). In a such situation the cargo remains on the supply vessel, and the master write in the remarks in the cargo manifest.

3.4 Example of the oil Field in the Polish Exclusive Economic Zone

In the Polish exclusive economic zone 60 nautical miles north of the Rozewie, there is a B-3 operating field. This place is a production center with(Fig. 8):

- Floating production Semi submersible jack up platform "Balic-Beta", which is the production center. On board of the installation there are sections: accommodation, office, production and control.
- Unmanned floating production semi-submersible platform "PG-1".
- subsea installations
- Weel production and injection.
- Subsea pipelines.
- Catenary Anchor Leg Mooring buoy.
- Oil tanker vessel.

The energetic resources extracted from the depth of 1450 m with separators are separated from each other and the gas is discharged by submarine pipeline on shore. It is used to drive turbines in the heat and power plant in Władysławowo. The crude oil subsea pipeline is directed to CALM buoy and from there to tanks of

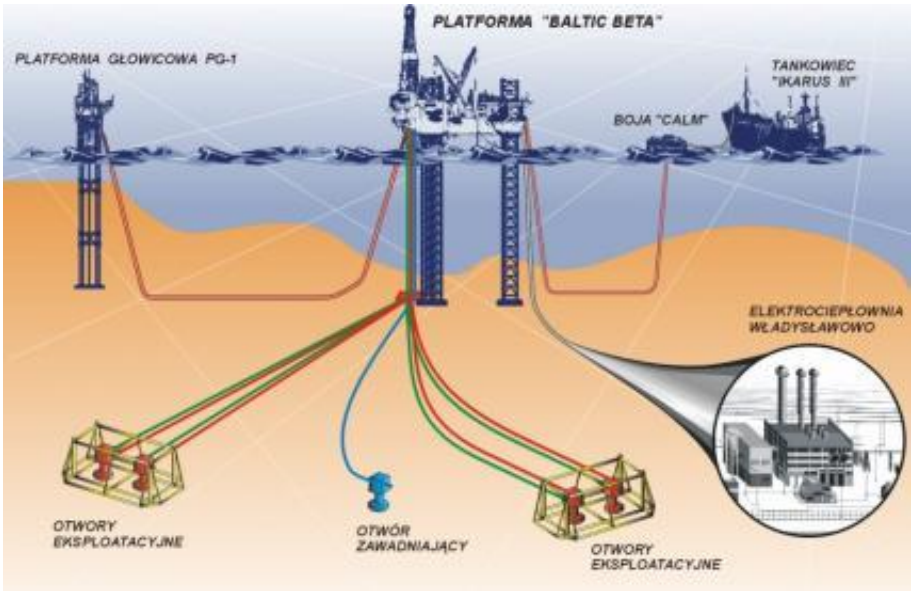


Fig. 8 Scheme overwiev marine mine in Polish EEZ in the oil field B3.
Sources: www.lotos.pl [12/05/2015]

oil tanker vessel. When the tanks are filled, the there is Ship to ship operation. Thanks to such possibilities, production on the installation is not stopped. Recovered from the extracted water, the water is used to inject holes to raise the pressure.

In the area of the mentioned area, the offshore vessels are provided stand-by in the safety zone and support to provide the necessary supply and do inventory operation and other required tasks.

4. Conclusion

Production energetic resources is an operation that requires the use of specialized infrastructure, but to be able to function properly service and a logistical support system must be provided. The solution in this area is access on line to the marine logistic system by everybody responsible for production and interested in delivery the required material. The system allows all participants supply, transport, shipper and receive access to the ordering system and provides cargo monitoring. The advantages of such a system are, besides of the view of the route of the order, but the estimation of the time of arrival and, the compatibility with other cargoes, which significantly reduces the cost by eliminating the empty cargo spaces. Moreover offshore vessel can provide provide the necessary manpower and technical reinforcement required so that the operational processes in the high seas continue smoothly and without any undesired interruptions. Offshore supply vessel transport the required structural components to the designated high seas sector along with providing assistance to supply freight as well.

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