Stand-By Vessels As Universal Guard For Norwegian Platforms

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MASTER THESIS

May 2013

Master Thesis

Availability

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Vestfold University College
Faculty of Technology and Maritime Sciences
P.O.Box 2243
N-3103 Tønsberg

TITLE

Stand-By Vessels As Universal Guard For Norwegian Platforms

AUTHOR

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DATE OF DELIVERY

15.05.2013

NUMBER OF PAGES

58

RESEARCH PROJECT

SUPERVISOR

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3 KEYWORDS

Vessels, Platforms, Emergency Response

SUMMARY

Safety stand-by vessels are one of the resources with which people who have ended up in the water can be rescued. The Emergency Response Plan defines the number of safety stand-by vessels that should be in the direct vicinity of the offshore installation at any given point, to be able to comply with the 20+20 and 120+20 minute requirements. Not every sea going vessel is suitable to act as a safety standby vessel.

SUMMARY (contin.)

Design and construction of safety stand-by vessels has evolved rapidly and continues to do so with new types, new technology and new roles coming to the forefront, although a number of challenges remain.

Also there are special standards and requirements, as well as certifications for stand-by vessels. Typically of our work is that in spite of the standards stand-by vessels are different from each other and there is an assumption that this difference affect the effectiveness of the emergency response.

The purpose of this work is to determine the most suitable stand-by vessel from a technical perspective in order to improve the level of platforms guard.

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Abbreviations

Abbreviation	Description
Nor.	Norway
SV	Stand-by Vessels
Plat.	Platforms
SP	Stril Poseidon
SH	Stril Herkules
EA	Esvagt Aurora
HSE	Health, Safety and Environment
IMO	International Maritime Organization
CA	Comparative Analysis
FRB	Fast Rescue Boats
FRDC	Fast Rescue Daughter Craft
L.o.a.	An overall length
L.p.p.	a length between perpendiculars
S.W.O.T.	Strengths, Weaknesses, Opportunities and Threats
ROV	Remotely Operated Vehicle
RSV	Regional Support Vessel
BP	British multinational oil and gas company
Radio C.	Radio Communication
ER	Equipment Requirements
RC	Receiving and caring for survivors
ERRVA	Emergency Rescue Response Vessel Association

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1. INTRODUCTION

1.1 Objectives of work

Design and construction of safety stand-by vessels has evolved rapidly and continues to do so with new types, new technology and new roles coming to the forefront, although a number of challenges remain.

The purpose of this work is:

- Determine the most suitable stand-by vessel from a technical perspective in order to improve the level of platforms guarded.

We chose this goal to determine the probability of the existence of the best vessel out of existing vessels which according to the expectations and standards of on-demand services are suitable for the guard of platforms.

SSV are one of the resources with which people who have ended up in the water can be rescued. The Emergency Response Plan defines the number of safety stand-by vessels that should be in the direct vicinity of the offshore installation at any given point, to be able to comply with the 20+20 and 120+20 minute requirements (Industry Guideline 2004). Not every sea going vessel is suitable to act as a SSV (ch. 2.5)

1.2 The work methodology

As a starting point we take the vessel SP because it is the best shield on the technical indicators which Statoil uses to protect its platforms. We will select two vessels which are often used in the protection of Statoil platforms and will be made comparison analysis and survey of the captains and vessels crews. The findings will show advantages and disadvantages of the vessels for making further improvements. During the research we will use comparative analysis, survey and S.W.O.T.-analysis.

2. THEORIES

2.1 Safety issues of oil production in the sea

The oil industry has always been dangerous work, and production on the continental shelf - is doubly dangerous. Sometimes production platforms sink: Even with there heavy and stable design, there can always be a "ninth wave". Although major accidents happen infrequently, an average of once in a decade, but then they are even more tragic (Environmental issues 2010).

In most cases, the cause of accidents on oil platforms is the result of a confluence of a number of factors, chief among them is the human factor (The explosion 2012). For example, Nor. semi-submersible platform Alexander Kielland turned over on the Ekofisk oil field on the North Sea, 27 March 1980 (Disasters 2010).

Consider another example where the cause of the accident was weather condition. The platform "Ocean Ranger" sank because of extreme weather conditions. When the platform was sinking, people jumped overboard without thinking that one could survive in ice water only a few minutes without special suits. Rescue helicopters at the time could not fly because of the storm. Because of the high waves, the team which had come on board to help unsuccessfully tried to take up the platforms worker from a single boat. All 84 persons died (Environmental Issues 2010). This shows us how important it is to strengthen the security, especially the quality of SV's which determines the effectiveness of emergency response.

The Norwegian major oil company Statoil is building a world-class international oil and gas company. This requires that it is among the absolute front runners on safety, both on technical aspects and safety operations (Safety 2009). Statoil principles for health, safety and environment are firmly anchored within its policies and procedures (HSE 2009).

Statoil continually strives to create a safe workplace for its employees and contract personnel, thus avoiding accidents (Safety 2009). Besides continuous focus on safety awareness, Statoil ensure high technical standards and inherent safety in the design and operation of all its plants and installations.

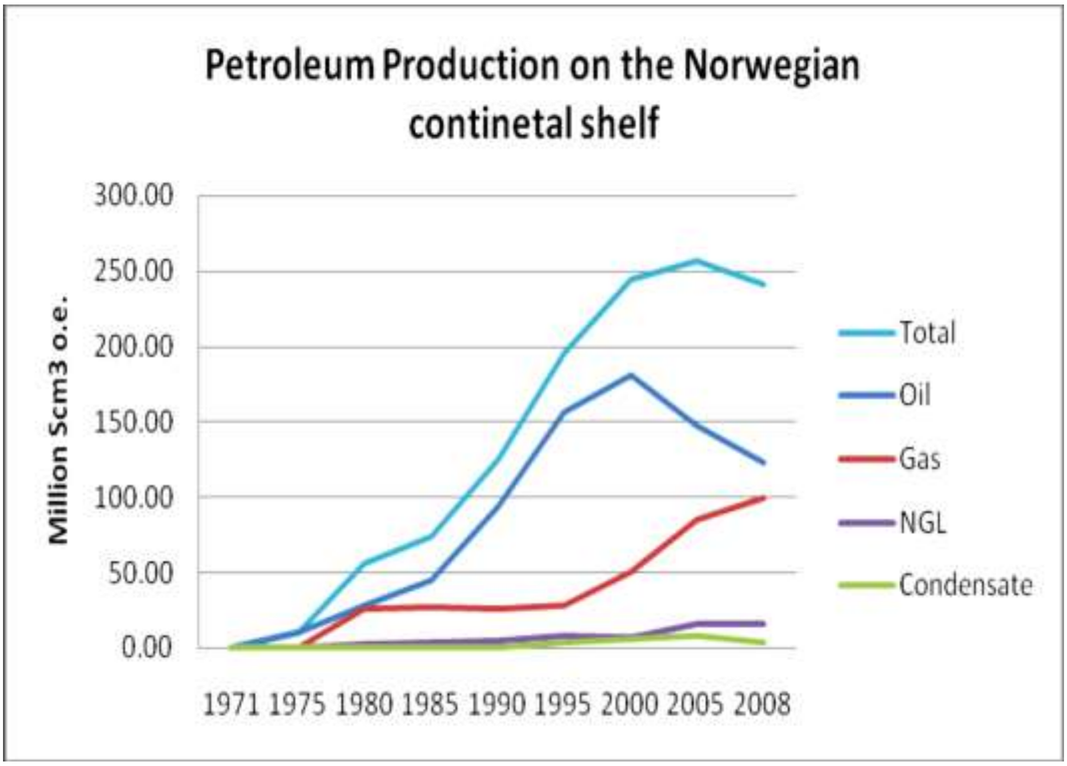
Risk management is a continuous process, and the cornerstone of HSE management for Statoil. As part of process Statoil will take appropriate measures to reduce the risk (Safety 2009). But the risk of accidents is always present, reflecting experience which indicates that an undesirable incident could happen now or at some time in the future (Safety 2009).

2.2 The history of oil production in Norway

Norway’s oil and gas production has increased substantially over the past 10 years, and the country ranks today as the world's third largest exporter of crude oil after Saudi Arabia and Russia. Petroleum operations now play a substantial role in Norway's economy, and contributes considerable revenues to the nation.As of 2009 there are 35 national and international operators on the Norwegian Continental Shelf. Furthermore there are additionally 23 other licensees and more apply and are evaluated for every concession round. It has not been possible to gain access to historical data on the development in the number of players on the Norwegian Continental Shelf, but experts critically emphasise that the number of players on the Norwegian Continental Shelf has decreased and that the market is becoming increasingly dominated by StatoilHydro, keeping new players out of the market and forcing smaller existing players out as well which is bad for the competition and development of the industry (Overview 2009).

The figure 1. below depicts the historical development of the four different petroleum resources as well as the change in total revenue.

Figure 1. Petroleum Production on the Norwegian Continental Shelf.



(Source: Overview 2009)

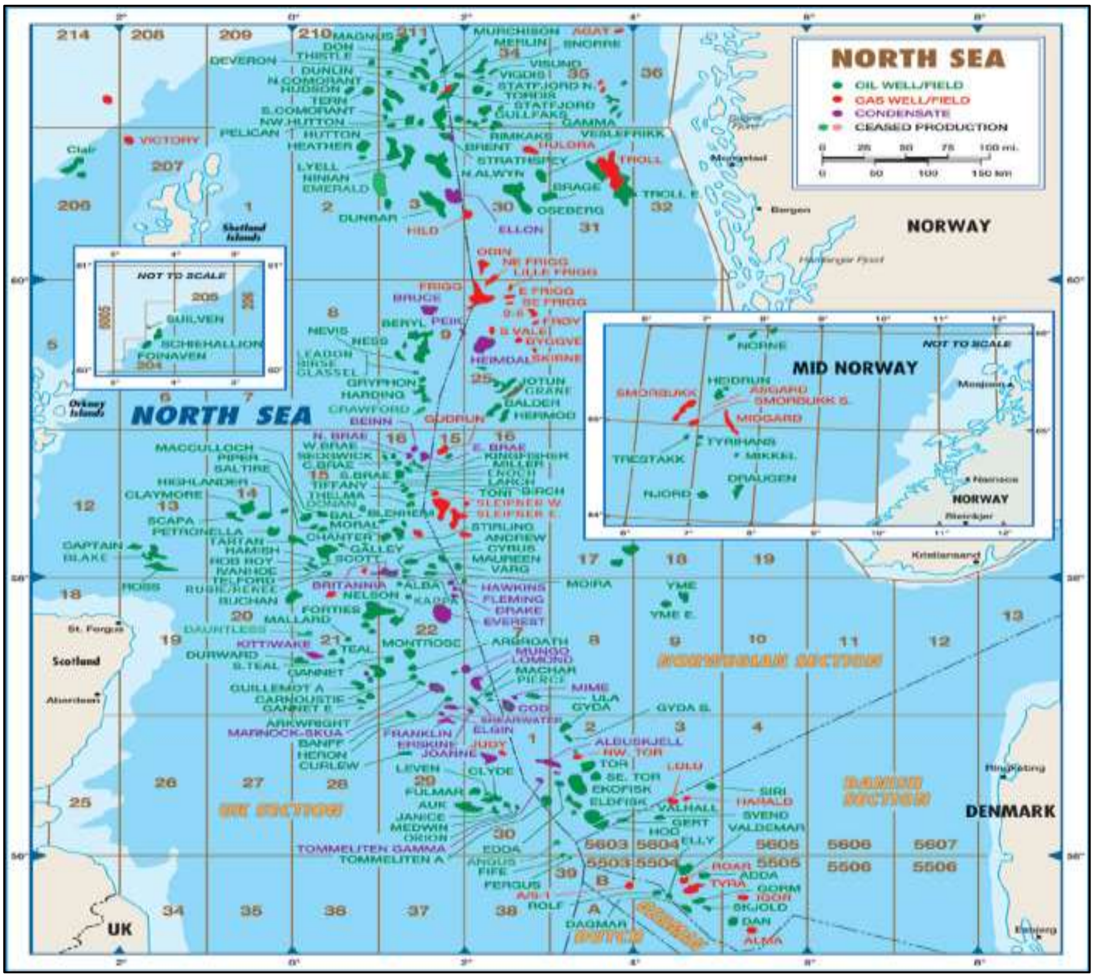
2.3 Norwegian oil platforms

The full field of oil producing companies on the Nor. continental shelf covers a large number of national and international companies.

In 2007, 982 oil and gas platforms stood in the North Sea. Great Britain and Norway owned the majority of the oil and gas platforms, namely 590 and 193 respectively. The Netherlands 143 platforms in the North Sea, Denmark 53 and Germany 3 (Overview 2009).

The North Sea map given below indicates the borders of the Nowegian Continental Shelf and location of Norway. P's.

Figure 2. The map Northern and Central North Sea fields both.



(Source: Central North Sea, 2002).

2.4 Environmental disasters and their implications

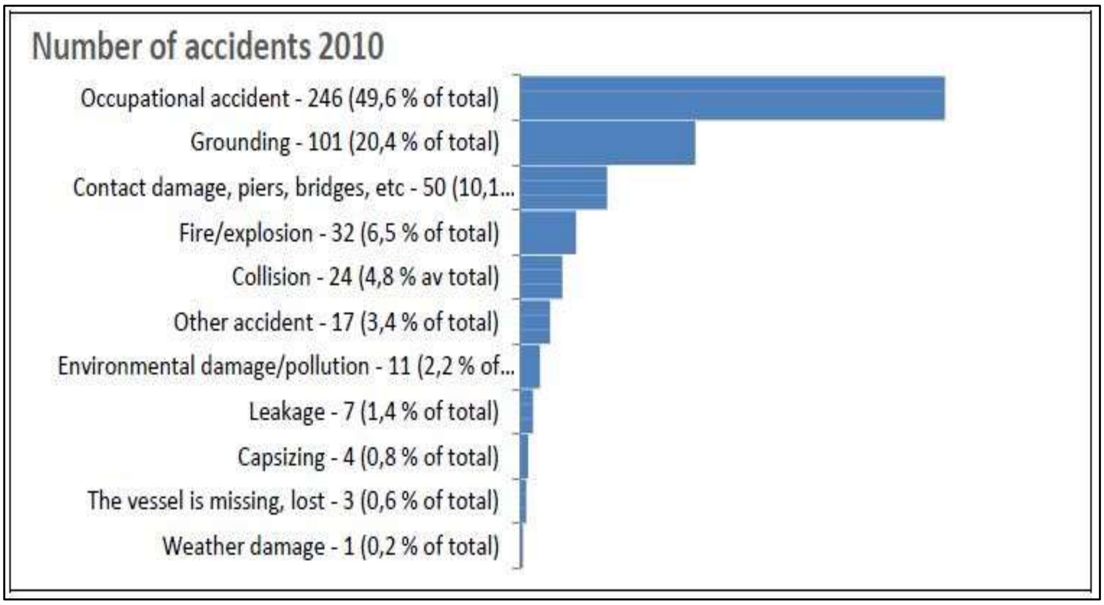
Learning from accidents is an expensive way of making improvements. It is then all the more important that precisely the knowledge that accidents provide is used to the greatest extent to prevent accidents (Marine Casualties 2011).

Causes of accidents are as a rule complicated and very resource-intensive to identify. A clear and true causal picture will also depend on an open flow of information from the industry to the authorities. Even with good dialogue, there will still be accidents where the individual element's effect on the accident is not explained, either for resource-related reasons or because the information is not available. However, the information that is available about the accidents will be important and useful in safety work (Marine Casualties 2011).

While it is gratifying to note that the total number of accidents on Norwegian vessels is steadily improving; the fact that a general increase in ship accidents underlines the urgency to mitigate accidents. This is unacceptable and requires a greater focus on safety in the industry (Marine Casualties 2011).

A total of 495 accidents were recorded in 2010. Figure 3 shows that this is a slight decrease (2%) compared to 2009. About half of the reported accidents are occupational accidents.

Figure 3. Accidents in 2010 by type of accident.



(Source: Marine Casualties 2011).

The data covers the period 1970 to 2007, in which there were a total of 553 accidents resulting in a total of 2171 fatalities (OGP 2010).

Table 4 lists all accidents resulting 10 or more fatalities along with the operating mode; the main event that caused the accidents, the extent of damage involved, and the geographic area where the platform was operating.

Table 5 provides a breakdown of number of fatalities and number of incidents by year period: Worldwide, 1970-2007.

Figure 4. Top Offshore Incidents Listed in Decreasing Order of Fatalities Involved: Worldwide, 1970 – 2007.

Accident Date (dd/mm/yyyy)	Installation/ Field[1]	Type of Unit	Operation Mode	Damage	Event Sequence[2]	No. of Fatalities[3]	No. of Injuries	Geographical Area
06/07/1988	Piper Alpha	Jacket	Production	Total loss	Release → Explosion → Fire	167	60	Europe North Sea
27/03/1980	Alexander L Kielland	Semi-submersible	Accommodation	Total loss	Breakage or fatigue → List → Capsizing, overturn, toppling	123	NA	Europe North Sea
03/11/1989	Seacrest	Drill ship	Exploration drilling	Severe damage	Breakage or fatigue → Capsizing, overturn, toppling	91	0	Asia South
15/02/1982	Ocean Ranger	Semi-submersible	Exploration drilling	Total loss	Breakage or fatigue → Leakage into hull → List → Capsizing, overturn, toppling	84	0	America North East
25/10/1983	Glomar Java Sea	Drill ship	Drilling, unknown phase	Total loss	Breakage or fatigue → Leakage into hull → List → Capsizing, overturn, toppling → Loss of buoyancy or sinking	81	0	Asia East
25/11/1979	Bohai II	Jackup	Transfer, wet	Total loss	Breakage or fatigue → Leakage into hull → List → Capsizing, overturn, toppling	72	0	Asia East
06/11/1986	Brent field	Helicopter-Offshore duty	Other	Total loss	Breakage or fatigue → Helicopter accident → Loss of buoyancy or sinking	45	2	Europe North Sea
16/08/1984	Enchova Central	Jacket	Development Drilling	Significant damage	Blowout → Fire → Explosion	42	19	America South East
11/08/2003	Neelam field	Helicopter-Offshore duty	Other	Total loss	Helicopter accident → Loss of buoyancy or sinking	27	0	Asia South
15/10/1995	DLB 269	Barge (not drilling)	Transfer, wet	Severe damage	Leakage into hull → List → Capsizing, overturn, toppling → Loss of buoyancy or sinking	26	0	Gulf of Mexico, excl. US
02/10/1997	Caspian Sea	Helicopter-Offshore duty	Other	Total loss	Helicopter accident → Loss of buoyancy or sinking	23	1	Caspian/Black Sea

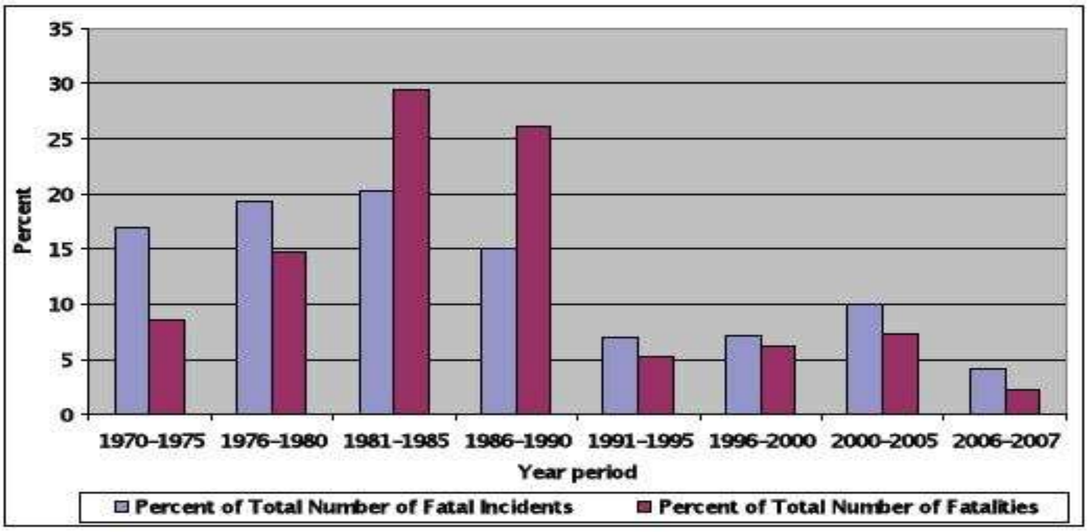
Accident Date (dd/mm/yyyy)	Installation/ Field[1]	Type of Unit	Operation Mode	Damage	Event Sequence[2]	No. of Fatalities[3]	No. of Injuries	Geographical Area
15/08/1991	McDermott Lay Barge 29	Lay barge	Construct. work unit	Total loss	Leakage into hull → Capsizing, overturn, toppling → Loss of buoyancy or sinking	22	NA	Asia South
23/10/2007[4]	Usumacinta	Jackup	Drilling	Severe damage	Collision → Release → Fire	22[4]	NA	Gulf of Mexico, excl. US
02/10/1980	Ron Tappmeyer	Jackup	Exploration drilling	Minor damage	Blowout	19	19	Middle East
09/10/1974	Gemini	Jackup	Drilling, unknown phase	Severe damage	Breakage or fatigue → Capsizing, overturn, toppling → Loss of buoyancy or sinking	18	0	Middle East
26/06/1978	Statfjord field	Helicopter-Offshore duty	Other	Total loss	Helicopter accident → Loss of buoyancy or sinking	18	0	Europe North Sea
08/12/1977	South Marsh, 128A	Helicopter-Offshore duty	Other	Total loss	Collision → Helicopter accident → Loss of buoyancy or sinking	17	1	US Gulf of Mexico
		Jacket	Production	Minor damage	Collision (helicopter)	17[5]	1[5]	US Gulf of Mexico
13/10/1971	Western Offshore 2	Drill barge	Exploration drilling	Severe damage	Blowout → Explosion → Fire	16	0	America South West
03/06/1978	Zakum field	Helicopter-Offshore duty	Other	Total loss	Helicopter accident → Loss of buoyancy or sinking	15	0	Middle East
17/11/1982	NA	Helicopter-Offshore duty	Other	Total loss	Collision (helicopter)	15	0	Asia East
21/12/1987	Eugene Island, 190	Helicopter-Offshore duty	Other	Total loss	Collision → Fire	15	0	US Gulf of Mexico
		Jackup	Stacked	Minor damage	Helicopter accident	15[2]	0	US Gulf of Mexico
20/03/1980	off Macae, Brazil	Helicopter-Offshore duty	Other	Total loss	Breakage or fatigue → Helicopter accident → Loss of buoyancy or sinking	14	0	America South East
17/10/1985	Trintoc Atlas	Mobile unit (not drilling)	Construct. work unit	Severe damage	Release → Explosion	14	0	Centr.Amer.East, not GoM

Accident Date (dd/mm/yyyy)	Installation/ Field[1]	Type of Unit	Operation Mode	Damage	Event Sequence[2]	No. of Fatalities[3]	No. of Injuries	Geographical Area
15/04/1976	Ocean Express	Jackup	Mobilizing	Total loss	Towline failure/rupture → Capsizing, overturn, toppling	13	0	US Gulf of Mexico
13/08/1981	Leman field	Helicopter-Offshore duty	Other	Total loss	Helicopter accident	13	0	Europe North Sea
30/04/1982	Gulf of Thailand	Helicopter-Offshore duty	Other	Total loss	Helicopter accident → Loss of buoyancy or sinking	13	0	Asia South
20/03/1983	B.O.S. 355	Barge (not drilling)	Construct. work unit	Severe damage	Explosion → Fire	13	32	Africa West
25/11/1990	Adriatic	Helicopter-Offshore duty	Other	Total loss	Breakage or fatigue → Helicopter accident	13	0	Europe South,Mediterr.
18/11/1998	Campeche S. field	Helicopter-Offshore duty	Other	Total loss	Collision → Loss of buoyancy or sinking	13	0	Gulf of Mexico, excl. US
23/11/1977	nr. Varhaug field	Helicopter-Offshore duty	Other	Total loss	Breakage or fatigue → Helicopter accident	12	0	Europe North Sea
08/09/1997	en route Norn field	Helicopter-Offshore duty	Other	Total loss	Helicopter accident → Loss of buoyancy or sinking	12	0	Europe North Sea
02/10/1999	off Dharan, Saudi Arabia	Helicopter-Offshore duty	Other	Severe damage	Helicopter accident → Loss of buoyancy or sinking	12	8	Middle East
27/07/2005	Bombay High North	Jacket	Production	Severe damage	Collision → Release → Fire	12	0	Asia South
29/05/1972	SS, 201	Helicopter-Offshore duty	Other	Total loss	Helicopter accident	11	NA	US Gulf of Mexico
04/06/1980	Opobo, Nigeria	Helicopter-Offshore duty	Other	Total loss	Helicopter accident → Loss of buoyancy or sinking	11	0	Africa West
20/05/1985	Tonkawa	Drill barge	Transfer, wet	Severe damage	List → Capsizing, overturn, toppling → Loss of buoyancy or sinking → Release	11	0	US Gulf of Mexico
03/10/1989	High Island Pipeline	Pipeline	Production	Significant damage	Collision → Release → Explosion → Fire	11	4	US Gulf of Mexico
14/03/1992	Cormorant field	Helicopter-Offshore duty	Other	Total loss	Helicopter accident → Loss of buoyancy or sinking	11	1	Europe North Sea

Accident Date (dd/mm/yyyy)	Installation/ Field[1]	Type of Unit	Operation Mode	Damage	Event Sequence[2]	No. of Fatalities[3]	No. of Injuries	Geographical Area
25/03/1993[6]	Lake Maracaibo	NA	NA	Significant damage	Explosion & Fire	11	NA	America South East
15/03/2001	Petrobras P-36	Semi-submersible	Production	Total loss	Explosion → Fire → Capsizing, overturn, toppling → Loss of buoyancy or sinking → Release	11	0	America South East
16/07/2002	Leman field	Helicopter-Offshore duty	Other	Total loss	Helicopter accident → Loss of buoyancy or sinking	11	0	Europe North Sea
24/03/2004	NA	Helicopter-Offshore duty	Other	Total loss	Helicopter accident → Loss of buoyancy or sinking	11	0	US Gulf of Mexico
27/05/1982	nr. Natuna Island	Helicopter-Offshore duty	Other	Total loss	Helicopter accident → Loss of buoyancy or sinking	10	0	Asia South
04/11/1985	Concem	Barge (not drilling)	Construct. work unit	Total loss	Capsizing, overturn, toppling	10	0	Europe North Sea
31/07/1989	Avco 5	Barge (not drilling)	Transfer, wet	Total loss	Capsizing, overturn, toppling	10	0	US Gulf of Mexico
05/05/1989	Bohai Harbour	Helicopter-Offshore duty	Other	Total loss	Breakage or fatigue → Helicopter accident	10	0	Asia East
06/12/1990	nr. Matak	Helicopter-Offshore duty	Other	Total loss	Explosion → Helicopter accident → Loss of buoyancy or sinking	10	2	Asia South
18/01/1995	Ubit	Jacket	Repair work/ under repair	Severe damage	Explosion & Fire	10	23	Africa West

(Source: OGP 2010).

Figure 5. Breakdown of Number of Fatalities and Number of Incidents by Year Period: Worldwide, 1970 – 2007.



(Source: OGP 2010).

Note:

1. This chart shows, for each period, the percentage of total incidents/fatalities in 1970-2007 that occurred during that period.
2. The period 2006-2007 represents only 2 years of data whereas the previous periods are 5 years.

2.5 The role of safety stand-by vessels

Design and construction of SSV has evolved rapidly and continues to do so with new types, new technology and new roles coming to the fore, although a number of challenges remain (SSV Continue 2009).

At the Annual OSJ Conference 2009,David Kenwright, Chairman of the ERRVA said "The one area where there is a major difference is that the supply and demand for SSVs has remained stable, and has not been the focus of major speculative investment by ship-owners from other market sectors" (SSV Continue 2009).

"However," Mr. Kenwright said, "most importantly, the need to exploit oil while the existing, ageing North Sea pipeline and platform infrastructure is operational will remain, especially as North Sea oil and gas production has reached a plateau and is in decline" (SSV Continue 2009).

As he noted, the weakening of Sterling against both the Euro and the Dollar, in an industry where revenue and costs are invariably in Sterling, has resulted in foreign seafarers seeing their income being eroded, and which if compensated for, inevitably leads to spiraling operating costs for ship-owners (SSV Continue 2009).

Nevertheless, Mr. Kenwright told delegates, "even considering all these factors, an ongoing need for investment will still be needed if the average age of the SSV fleet is to be maintained at the present level, and if the inventory of vessels is to be maintained at an adequate number to meet not only present but future demand."

As is well known, not that long ago, most SSVs were converted fishing vessels and hence of relatively low specification and performance, with relatively poor maneuverability. They had minimal modifications to suit them to their new role, limited space and facilities for crew and survivors, also limited rescue equipment. Moreover, launch and recovery arrangements were not always ideal and there was little or no additional training of seafarers, who, although well qualified in their own field, had little or no experience of rescue operations (SSV Continue 2009).

The most important milestone in offshore rescue and recovery was, of course, those changes implemented following the Piper Alpha disaster, the world's worst offshore accident. The findings of Lord Cullen's inquiry led to widespread new thinking (SSV Continue 2009).

The first generation combined the role of a SSV with those of a PSV, providing supply and infield cargo operations. More recently, such multi-role SSVs have also begun to be used at the platforms for ROV work and potentially many other roles too, such as emergency towing and tanker assist, emergency dive support and providing offshore accommodation and access to platforms (SSV Continue 2009).

To date, there are specific standards and requirements for SSV. On the grounds of article 3.37v of the Working Conditions Decree an Emergency Response Plan must be formulated for each offshore installation situated in these waters (Industry Guideline 2004).

The Emergency Response Plan must indicate the way in which the resources with which people that have fallen overboard or have ended up in the sea after evacuation from the offshore installation can be rescued and how the rescued people will be transferred to a safe haven alive (Industry Guideline 2004).

A sea going vessel that complies with these requirements and is further supported by an ISM-certified ship owner is eligible for the "Safety stand-by vessel" certificate (Industry Guideline 2004).

A SSV must be immediately deployable at all times to:

- rescue one or more people from the offshore installation from the water;
- take on board people who have left the offshore installation by means of evacuation ,
- with the aid of rafts;
- take on board part of or the entire crew who have left the offshore installation
- life boats under controlled circumstances;
- administer first aid;
- act as a safe haven;
- be in command on site (function as "on scene co-coordinator");

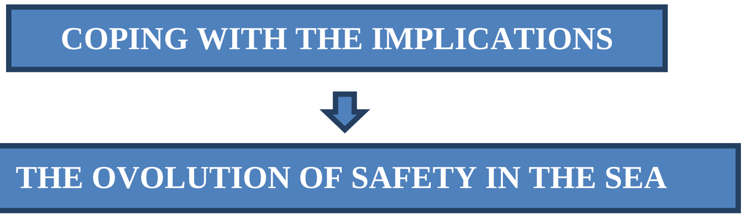
A SSV can undertake action independently, if the circumstances so dictate. In the event of an emergency on or around the offshore installation, the head of the offshore installation (OIM) acts as the on-scene-coordinator. If the head of the offshore installation is not able to do so, then a suitably qualified member of the safety stand-by vessel crew acts as on-scene coordinator and coordinates all necessary activities up until the moment the coast guard appoints another on-scene coordinator.

A safety stand-by vessel must be able at all times to demonstrate that she complies with the performance norms3 defined in the Emergency Response Plan. The head of the offshore installation must check this regularly (Industry Guideline 2004).

2.6 The evolution of safety in the sea

Disasters and accidents of various sizes with a variety of implications served as the reason of evolution of safety in the sea. Evolution of safety in the sea has its own history. In short it took place along the following scenario:

Figure 6. Scenario of the evolution of safety in the sea.



(Source: Author description)

For the development of safety in the sea have been taken as a set of conventions like COLREGS, MARPOL; established the Governmental Maritime Consultative Organization (later IMO), adopted the standards like the SOLAS also adopted International Management Code for the Safe Operation of Ships and for Pollution Prevention etc.

2.7 ISM Code

Short name: «The International Safety Management Code".

Full name: «The International Management Code for the **Safe Operation** of Ships and for **Pollution Prevention**" (What is ISM).
The objectives of the Code are to ensure safety at sea, prevention of human injury or loss of life, and avoidance of damage to the environment, in particular to the marine environment and to property (ISM Code 2010).

Safety management objectives of the Company should, inter alia:

- provide for safe practices in ship operation and a safe working environment;

- assess all identified risks to its ships, personnel and the environment and establish appropriate safeguards; and
- continuously improve safety management skills of personnel ashore and aboard ships, including preparing for emergencies related both to safety and environmental protection (ISM Code 2010).

3. DESCRIPTION OF RESEACH PROBLEM

3.1 Topicality of research

The Norwegian major oil company is Statoil. Let's consider how Statoil strengthens the safety of their platforms.

Statoil has collaborated with the relevant shipping companies to improve the safety of offshore supply, emergency response and anchor handling operations. Special attention is also paid to the vessels to guard the Statoil's platform (New SV 2002).

An example of this is the contract for the construction and exploitation of a new SV for the fields Halten /Nordland area of the Norwegian Sea. The contract value is approximately NOK 600 million. Statoil entered into a cooperation agreement with Shell and Norsk Hydro for shared stand-by vessels in the Halten/Nordland area (New SV 2002).

"The SV is the final stage in the work of establishing an emergency response plan for the Halten/Nordland area. The ship represents a new type of vessel with features we haven't seen before," reports Steinar Solvang, responsible for health, safety and the environment in Statoil's Halten/Nordland business cluster (New SV 2002).

The new vessel equipped a helicopter pad; this will enable combined operations with the search and rescue (SAR) helicopter, which is also included in the emergency response plan for Halten/Nordland (New SV 2002).

The vessel plays a key role in oil spill preparedness. In addition to oil protection equipment, it will have a workshop for analyzing oil discharges. There are technologies on board that can be used with the helicopter to combat oil spills.

The SV will be around 90 meters long and 18 meters wide. It will be able to maintain a speed of 20 knots and will have a crew of 12. The ship will be built at Aker Aukra, in cooperation with Langsten, in western Norway (New SV 2002).

Later, letters of intent worth some NOK 1.6 billion, including options, have been awarded by Statoil to the Møkster Safety shipping company for delivery of two

stand-by vessels (Two SV Ordered 2006). Møkster Safety is a subsidiary of Stavanger Company Simon Møkster Shipping (New SV 2002).

The agreements cover two identical vessels, both new ships. One will be a stand-by vessel for the Tampen area in the North Sea and is due to be delivered in February 2008. The other, to be delivered in October 2008, will be used as a relief vessel in the Exploration & Production Norway (UPN) pool (Two SV Ordered 2006).

The stand-by ship which is going to Tampen will replace the two vessels currently used for emergency response, saving the Tampen licenses NOK 50 million per year.

"With this ultra-modern vessel, we are strengthening both emergency response and safety," comments Lars Christian Bacher, senior vice president for the Tampen business cluster (Two SV Ordered 2006).

"On Tampen we regard all resource units and licenses as one and the same license. This has been a crucial factor in our decision to take in the new vessel" (Two SV Ordered 2006).

The new ships have been designed by consultant Vik & Sandvik. They represent a further development of the Stril Poseidon, which is the stand-by vessel Statoil uses in the Halten Bank area (Two SV Ordered 2006).

The vessels will be more useable and robust than the ships they are replacing. A particular difference between these and other stand-by ships is their ability to pull lifeboats directly on board in extreme weather conditions via a special stern slipway. The vessels' man overboard (MOB) boats are normally launched and retrieved through this slipway (Two SV Ordered 2006).

Other facilities include a sick bay and a helideck, which makes it possible to secure rapid medical assistance as well as to evacuate people from the vessel, if necessary (Two SV Ordered 2006).

Both agreements will run for a 10-year period, with five one-year extension options. The shipyard has not yet disclosed where the vessels will be built, but confirms that it is a Norwegian shipyard that has got the job (Two SV Ordered 2006).

Now let’s consider emergency response and rescue the sector invests in the North Sea: The North Sea's emergency response and rescue vessel sector has embarked on one of its biggest investment programs of recent years - and casted a vote of confidence in the region in the process (Emergency Response 2005).

Operators have placed orders worth approximately £130million in total for new tonnage in an 18-vessel-strong modernization program also fuelled in part by strategic plans to explore opportunities in new operating markets.

There has been a series of announcements in recent months by members of the ERRVA:

- Craig Group Division, North Star Shipping, has placed orders for seven vessels with the Spanish shipyard Astillerios Balenciaga in deals worth £40million;
- Viking Offshore has announced the construction of six new vessels at the Spanish yard Astillerios Zamakona, with an option for a further three, in deals valued at £55million in total;
- Esvagt is currently building four new vessels, in addition to the two vessels delivered in the past 12 months, in deals valued at £30million in total (Emergency Response 2005).

ERRVA Chairman John Wilson said:

"These investments reflect both the current upturn in North Sea activity and the confidence of rescue and recovery vessel operators in the province's long-term prospects (Emergency Response 2005).

"If you take into account other developments such as BUE Marine's order for a new vessel - currently under construction in Singapore and due for delivery in June 2006 to support its operations in other provinces - they indicate a sense of stability and optimism in our sector generally" (Emergency Response 2005).

"An ongoing program of modernization is key to ensuring the sector is equipped to meet the needs of the offshore industry for many years to come, and to positioning members to exploit opportunities in other geographical markets as they arise".

"More broadly, the sector is adapting to meet the changing circumstances of the industry it serves" (Emergency Response 2005).

"There will always be a requirement for such vessels as long as manned installations remain the focus of offshore exploration and production activity; not least is emergency circumstances when weather conditions are severe, for example, when other rescue series are unable to be deployed. As the infrastructure grows older, weather profiles continue to change and the risk of human error remains, it is critically important that rescue and recovery vessels respond" (Emergency Response 2005).

"ERRVA members are doing so by designing vessels that meet those challenges, by introducing more sophisticated rescue equipment and by updating and enhancing training techniques continually (Emergency Response 2005).

"Our emergency response and rescue vessel activity is maturing into one of the finest rescue services of its kind in the world, but we can never be complacent."

Around 3,000 seafarers employed on the 120 vessels deployed on station throughout the year, in all weathers, as a 'safety blanket' for offshore crews.

They also fulfill a series of additional roles, including pollution control assistance and anti-collision monitoring (Emergency Response 2005).

Also John Wilson added:

"ERRVA has been in existence now for over 20 years, but the role of its members is not a prominent one unless they are called into action. Yet it is these ships and their crews that are the first on scene in any major incident offshore, providing the front line of the rescue services that offshore operators require in the event of an emergency occurring" (Emergency Response 2005).

The SV "Havila Troll," which undertakes tendering duties in the Oseberg and Troll area, rescued the crew of three from the Danish trawler "Heidi Christine" which started taking on water and sank on Tuesday evening. "It's good to know how well crew and equipment work in a real situation," says Chief Officer Øystein Høgseth, who took part in the rescue operation (SV Rescued 2004).

"Havila Troll" is a specially-built SV equipped with a man overboard rescue boat. The vessel covers areas around Hydro's and Statoil's installations in the Oseberg and Troll areas (SV Rescued 2004).

On Tuesday the crew and vessel demonstrated their abilities in a real situation. Three Danish fishermen from the trawler "Heidi Christine" from Hanstholm were rescued from their life raft less than 15 minutes after their mayday call (SV Rescued 2004).

"This is something we train for regularly. Last night we showed that the equipment is effective and the crew quick to launch the man overboard boat and rescue the people onboard. We’re obviously very happy to be of assistance when people are in distress," says Øystein Høgset from the bridge on "Havila Troll" (SV Rescued 2004).

"Havila Troll" was taken into operation in the fall of 2003. This is the first time that the vessel has taken part in an actual rescue operation (SV Rescued 2004).

The weather in the area was good with a gentle breeze and one to two meter high waves. The three Danish fishermen were in good form, and were served dinner onboard "Havila Troll" before being transported to land by helicopter (SV Rescued 2004).

This once again proves the efficiency of the stand-by vessels.

We have considered the importance of the role of stand-by vessels in protecting of the platforms, as well as their effectiveness. Now we will consider the quality of vessels that serve to protect the platform as a tool to respond to emergency situations. As we know, there are standards and requirements for stand-by ships (ch. 2.5, ch.2.7). But in spite of that, depending on the manufacturer of the vessel there are differences in design as well as equipment. Hence the following questions:

- Whether these differences are what matter?
- Whether these differences influence the efficiency of the courts?

In the study, we will look for answers to the above questions. If these differences are significant and affect the performance, our goal is to identify these differences and to determine the most efficient vessel for the protection of platforms. And will also discuss the individual components of the existing benefit.

4. COMPARATIVE ANALYSIS

4.1 Comparative analysis

The method of comparative analysis is the most versatile of the scientific methods of research. It is an epistemological rod and the guide, which gives the general direction of research and regulating the interaction of all the methods. It is used, inter alias as a base for statistical, sociological and factor analysis, at classification, estimation, forecasting processes and phenomena (Gudkov 2008).

In an analysis of each of the objects being compared are logically bifurcates: it is found, on the one hand, that it is shared with other objects, and on the other - is what distinguishes it from other objects (Gudkov 2008). A comparative analysis method will be used based on pairwise comparisons of objects and components.

This method has the following advantages:

- The possibility of the integration of expert judgments about objects;

- Ability to use all types of evaluations: numeric, meaningful, "yes-no", etc.

The main drawback of the methods in this class - the need for a large number of pairwise comparisons, is a lot of work for the person (Gudkov 2008).

In order to solve key problems that arise in the assessment of multi-criteria made the following work:

- ➢ compiled a list of data objects to be compared;
- ➢ Following certain basic list of criteria that will be compared;
    - Main dimensions;
    - Tank capacity;
    - Engine and propulsion;
    - Deck machinery;
    - Speed;
    - Slip and rescue equipment;
    - Accommodation
- ➢ single estimate of objects defined by the following criteria:

- "Excellent" match the numeric value from 0.8 to 1;
- "Good" - from 0.63 to 0.79;
- "Satisfactory" - from 0.37 to 0.62;
- "Bad" - from 0.2 to 0.36;
- "Very bad" - from 0 to 0.19 (Gudkov 2008).

4.2 Stril Poseidon, as a start point

The SP was built by Aker Langsten for owner Simon Møkster Shipping in Stavanger. It is a third-generation rapid response rescue vessel, which will be used on Statoil's Haltenbank fields. The vessel was designed as a cooperation between Vik-Sandvik, Aker and Møkster Shipping (Stril Poseidon).

Picture 1. Stril Poseidon.

(Source: Field Support).

The SP has an overall length of 91.4m, a length of 78.25m between perpendiculars and a draft of 6.5m. Its beam is 18.2m. The depth to the first deck is 7.5m and 4.5m to the second deck. It registers deadweight of 2,500t. The funnel is offset and lowered, ensuring an almost 360° view from anywhere on the bridge. The vessel has accommodation for 25 persons as well as a sick bay and a helideck rated for a Super Puma which makes it possible to secure rapid medical assistance as well as to evacuate people from the vessel, if necessary (Stril Poseidon).

It is designed to remain on-station year-round except for annual dry docking for maintenance. The cargo of food and water is loaded when the vessel reaches the offshore platforms. It can be refueled at sea (Stril Poseidon 2003). The vessel can store up to 1,000m^3 of marine diesel oil as well as 250m^3 of fresh water and 1,100m^3 of ballast water.

FAST RESCUE BOATS

A key feature of the SP is a slipway built into the stern of the vessel, designed for the deployment of a Fast Rescue Daughter Craft (FRDC). This is surrounded by a hatched cover for weather protection and a gate with sliding doors sealing off the stern. This is the first time such a system has been used on a field support/stand-by vessel (Stril Poseidon).

The vessel has three main rescue boats: an NP-741 Springer, an MP-1111 FRDC WJ and an MP-710 TUG for oil boom towing. The MOB (man overboard boat) is located in its own hanger which is located portside, midship.

Rescue craft up to 9.1m can be housed within the 'mother vessel' and deployed from its internal slipway. It can also double as a pickup area for free fall lifeboats so that survivors can be transferred unaffected by weather conditions outside the ship. The sick-bay is on the same level as the slipway (Stril Poseidon).

RAPID OIL SPILL REACTION

The vessel is equipped with a Transres 150 system, oil booms and skimmers for instant action on an oil spill. It also carries 50m^3 of dispersant. The availability of such equipment offshore rapidly decreases the time necessary to respond to an oil spill incident (Stril Poseidon).

EMERGENCY TOWING

The vessel can carry out emergency towing. The deck machinery includes a 120/250t towing winch, an 8.5m drum, a 22t tagger winch and a 10t capstan as well as a boat recovery winch. There is a 300t shark jaw and a 300t towing pin. The deck crane is rated for 5t at 10m (Stril Poseidon).

<u>ENGINES</u>

The main engines of the SP are two CAT 3612 TA engines at 4,250BkW 1,000rpm. There are also three CAT 3508 BTA, 968BkW 1,800rpm auxiliary engines and a CAT 3306 TA 184BkW 1,800rpm emergency generator. This linked to a propulsion system consisting of a pair of ACC95 850k units. The vessel also has four 'super-silent' Brunvoll thrusters: an 800kW bow thruster, a 1,450kW azimuth thruster and a pair of 600kW stern thrusters. This gives the vessel a speed of 20knots at a 5.1m draught (Stril Poseidon).

Maneuvering equipment includes a pair of high-lift spade rudders and steering gear for parallel/split operation. There are also two roll reduction tanks.

<u>CONTROLS</u>

The integrated bridge and dynamic positioning system is supplied by Kongsberg/Norcontrol bridge line.

Stril Poseidon is classified by DNV under the notation +1A1,EO,Tug,SF Autr,Fi-Fi I+II,Clean<Conf,Oil Rec,Helideck SH (Stril Poseidon).

4.3 Comparative analysis of vessels

To perform the comparative task, SH and EA, the two most frequently used vessels for guard purposes, have been taken in account. Apart from this, due to the fact that they have been designed with high tech technology and implementation of the most apt engineering ideas, the mentioned vessels are considered to be the best ones in the guard system.

The EA is the third vessel designed and built by Zamakona Yards for Esvagt AS.

The difference between EA and the other vessels from her class is the fact that she has been designed and built implementing new non-standardized systems, which are not available in the market.

With the development of this new project, Zamakona Yards designs and builds a rescue or stand-by vessel which puts at the disposal of the Owner the technological means capable of satisfying future demands of the Norwegian oil industry (NORSOK R-002 norm) avoiding foreseeable and expensive improvements in the near future in and adapting conventional systems to the new regulations (Innovation for the oil industry 2012).

These new systems consist of:

- Launching and recovery of rescue boats systems with high chemical and structural resistance.
- New type of double dispersant spray system, specifically designed for x-bow vessels.
- New sound proof system for the housing and the bow thruster's tunnels.

Thus achieving an increase in the quality of the systems in her operative life span and improving the efficiency and effectiveness as well as the comfort and living conditions on board (Innovation for the oil industry 2012.

This new prototype is a multipurpose stand-by vessel with an X-bow design with a wide capacity to carry out:

- Rescue in case of emergency at offshore facilities
- Emergency towing
- Fire-fighting
- Operations with ROV (remote operated vehicle)
- Pollution-fighting and residue recovery
- Supplying off-shore oil rigs or installations (Innovation for the oil industry 2012).

The list below is criteria according to which comparative analysis will be made.

Main dimensions:

- L.o.a.
- L.p.p.
- Breadth
- Gross tonnage
- Deadweight
- Main deck
- draft summer

Tank capacity:

- Full oil own supply
- Fresh water
- Dispersant
- Water ballast

Engine and propulsion:

- Main engines
- Auxiliary engines
- Emergency generator
- Main propellers
- x Azimuth thruster
- x Stern thrusters
- Maneuvering thruster
- Propulsion diesel engine P
- Propulsion diesel engine S
- Propulsion reduction gear P
- Propulsion reduction gear S

Speed and consumption:

- In calm sea
- In the stand-by mode

Deck machinery:

- Towing winch

- Brake holding
- Deck Crane
- Tugger winch
- Capstans
- Towing pins and Shark Jaw
- Boat recovery winch

Slip and rescue equipment:

- Rescue boats
- Slip way solution for safe entry of rescue boats and life boats.

Accommodation and Survivor capacity:

The tables below show the comparison of the vessels taking into account the above-mentioned criteria.

Table 1. Comparative analysis of stand-by vessels by main dimensions.
Source: (Author's own compilation).

The vessels name		SP	SH	EA
Main dimensions	L.o.a.	91.4 m	97.55m	87.00m
	L.p.p.	78.25 m	84.85m	81.00m
	Breadth	18.2 m	19.20m	17.00m
	Gross tonnage	4785 t	6251 t	4462 t
	Deadweight	2500 t	2100 t	2300 t
	Main deck	7.5 m	8.00 m	7.5 m
	draft summer	6.5	6.48	6.00

In the course of the analysis distinctive differences in emergency effectiveness between the three vessels have not been detected. The vessels have been designed and built according to IMO standards and requirements. Therefore, taking into consideration further evolution of technology, the three vessels have been assessed as 0.7 (good).

Table 2. Comparative analysis of stand-by vessels by tank capacity.
Source: (Author's own compilation).

Thevesselsname		SP	SH	EA
Tank capacity	Full oil own supply	1000 m3	786 m^3	1200 m3
	Fresh water	250 m3	439 m^3	300 m3
	Dispersant	50 m3	531 m^3	50 m3
	Water ballast	1100 m3	2300 m^3	1400 m3

Table 2 indicates that the volume of dispersant of SH is 10 times greater than that of SP and EA. Thus, it can be inferred that SH is more successful in oil spill emergency operations which is one of its advantages. As for the other criteria, the vessels do not have great differences that would have impact on their effectiveness in emergency operations. Hence, SH has been assessed as 0.8 (good); SP and EA have been assessed as 0.6 (satisfactory).

Table 3. Comparative analysis of stand-by vessels by engine and propulsion.
Source: (Author's own compilation).

The vessels name		SP	SH	EA
Engine and propulsion	Main engines	2 x CAT 3612 TA engines at 4,250BkW 1,000rpm	2 x MAK 4500 BKW1000 rpm	4 × MAN 6L21/31
	Auxiliary engines	3 x CAT 3508 BTA, 968BkW 1,800rpm	1x CAT 3516C 2350 BKW at 1800 rpm 2x CAT 3508B 968 BKW at 1800 rpm 2x CAT C18 TTA 805 hp (601 kW) at 1800 rpm	4 x 1.260 ekW at 900 rpm + 2 x 2.100 ekW at 1800 rpm

	Emergency generator	HC.M434C2 - CAT 3306 TA 184BkW 1,800rpm	C9 - 1x CAT C9 DITA 215 BKW 1800 rpm	D12 - 1 x 350 ekW. at 1.800 rpm
	Brunvoll thrusters	4 x Brunvoll thrusters	Brunvoll 1 x Bow thruster 1200 kW	2 x Brunvoll thrusters
	Main propellers	A pair of ACC95 850k units	Scana Volda 2x ACG 95 / 850 Kwith PTI booster.	2 azimuth CPP
	x Azimuth thruster	1,450kW	1800 kW	2 x 883 kW
	x Stern thrusters	2 x 600kW	800 kW	1 x 850 kW
	Maneuvering thruster	3 x FU 63	1 x FU 80; 2 x FU 63	2 x FU 80
	Propulsion diesel engine P	3612 Caterpillar Inc.	9M32C	Electric power unit
	Propulsion diesel engine S	3612 Caterpillar Inc.	9M32C	Electric power unit
	Propulsion reduction gear P	ACG 85/680/PF 550 - 1L	EACG 850	SRP 3030 CP
	Propulsion reduction gear S	ACG 85/680/PF 550 - 1L	EACG 850	SRP 3030 CP

From the data on Table 3, each ship has its own characteristics, from a technical and environmental point of view. All three ships meet environmental and technical requirements that are considered most important for stand-by vessels in their rescue operations. Based on this, all three vessels in terms of Engine and propulsion receive identical scores of 0.8.

Table 4. Comparative analysis of stand-by vessels by speed and consumption.

Source: (Author's own compilation).

Thevesselsname	SP	SH	EA
Speed	20 knots	21,5 knots	15,3 knots
Consumption at stand-by mode	3-6 tons MDO day	4-7 tons MGO day	4,8 tons MDO day

Speed and fuel consumption is a very important indicator for stand-by vessels, since these parameters are the prime impact on the efficiency of the vessels. As comparison shows, SP and SH significantly differ in speed from EA and it gives it an advantage. As we can see on fuel consumption SH is inferior compared to SP and EA, regardless of the type of fuel the price difference is not so great between MDO and MGO. As a result, vessels are awarded points as follows: SP 0.8, SH 0.75, EA 0.75.

Table 5. Comparative analysis of stand-by vessels by deck machinery.

Source: (Author's own compilation).

<table>
<tr><th colspan="2">The vessels name</th><th>SP</th><th>SH</th><th>EA</th></tr>
<tr><td rowspan="5">Deck machinery</td><td>Towing winch</td><td>120/250t</td><td>120tons</td><td>100 Tons</td></tr>
<tr><td>Brake holding</td><td>300 t</td><td>250 tons</td><td>250 tons</td></tr>
<tr><td>Deck Crane</td><td>5t at 10m.</td><td>5T /16 mts</td><td>5 T / 13 mts</td></tr>
<tr><td>Tugger winch</td><td>22t</td><td>15 tons swl.</td><td>2-pieces: 15 Tons at 30 m/min</td></tr>
<tr><td>Capstans</td><td>10t</td><td>15 tons swl.</td><td>2-pieces: 10 Tons at 20 m/min</td></tr>
</table>

	Towing pins and Shark Jaw	300Tons	300Tons	250 Tons
	Boat recovery winch	10t	25 T Brake load 75T Speed 0-120 m/min in two steps	-

According to the table above, SP and SH are different from EA in the way that they both have an extra boat recovery winch. The capacity of SP's boat recovery winch is 10 tons and that of SH is 25 tons. However, EA is equipped with 2 pieces of 15 ton tugger winch, while SP is equipped with a 22 ton and SH - a 15 ton tugger winch. This, in fact, makes it clear that EA prevails over the other two. When it comes to capacity of Towing pins and Shark Jaw, SP and SH are identical, as for EA, its capacity is a little lower. In towing winch and brake holding criteria, SP has the highest indicator. Thus, SP, SH, and EA are assessed as 0.7, 0.6, and 0.6 respectively.

Table 6. Comparative analysis of stand-by vessels by slip and rescue.
Source: (Author's own compilation).

The vessels name		**SP**	**SH**	**EA**
Slip and rescue equipment	Rescue boats:	1 x FRC NP 741 Springer, 32 - 33 knots, 10 persons; 1 x Daughter Craft MP-1111 FRDC, 34 - 35 knots, 26 persons; 1 x MP-710 TUG,	1x GTC 900 GTC 90030 knots, 10 persons; 1 x Daughter Craft MS DC 12, 35 knots, 24 persons	2 x Esvagt FRB 15C, 33 knots, 15 persons

	Slip way solution for safe entry of rescue boats and life boats	Fi-Fi II 2 x 7200 m3/h, Throw length 180m Height 110m	FIFI l&ll 2 x 3600 m^s/h Throw length 180m Height 110m Additional FIFI cannon aft 1x 1200 m'/h	FiFi I+II 2 x 2400 m3/h Throw length 180m Height 110m
		1 x Helicopter deck	1 x Helicopter deck	1 x Helicopter deck
		SECurus ERRV	SECurus ERRV	SECurus ERRV

As comparison shows, all three vessels have different fast rescue boats that have different characteristics. SP has three fast rescue boats. We consider separately the difference between fast rescue boats of stand-by vessels. Stril Poseidon has one FRCNP 741 Springer at 32 - 33 knots, with a capacity of 10 persons and one Daughter Craft MP-1111 FRDC, at 34 - 35 knots, with a capacity of 26 persons. Stril Hercules is equipped with one 900 GTC GTC900 with a speed of 30 knots, with a capacity of 10 persons, one Daughter Craft MS DC 12, with a speed of 35 knots, with a capacity of 24 persons and EA is equipped with two FRB 15C, with a speed of 33 knots and a capacity of 15 persons. According to these criteria, we can clearly see that SP and SH have advantages over EA. As well as the comparison showed, Stril Poseidon has another advantage that gives it more opportunities in their rescue operations and gives the position of leader among the reference vessel. Its advantages are that it has one MP-710 TUG tow with a pull force of 2000 kg. Two Fi-Fi II system with a capacity of 7200 m3 / h, Throw-length 180m Height 110m which is equipped SP shows that SH and EA significantly behind him. This is its (SP) additional advantage. By this indicator, SH is in the second position, since it exceeds EA in both performance and the number of FiFi I+II.

As a result of comparison, the vessels assessed the following points: 1 point SP and SH, EA 0.75 and 0.65 points.

Table 7. Comparative analysis of stand-by vessels by accommodation.

Source: (Author's own compilation).

The vessels name	**SP**	**SH**	**EA**
Accommodation	25 person	40 person	40 person
Survivor capacity	370persons	370 persons	370 persons

Comparing the accommodations of the vessel SP from their brothers in the service lags by 15 people. This gives advantages SH and EA over the SP. Survivor capacity in terms of all three boats have the same opportunities. The comparison for Accommodation and Survivor capacity vessels awarded to the following points: SP 0.6; SH and EA at 0.7.

According to the overall result of the comparative analysis the following date was obtained:

- SP score of 0.74 taking the position of leader.
- After that the number of points at the rate of 0.72 SH in the second position.
- And with a score of 0.68 EA is taking a 3-position.

5. SURVEY

5.1 Survey of captains and vessels crew

Objectives of the survey to the captain and crew of SV are defining the benefits and drawbacks of these vessels. The survey refers to the integrity and the experience of the captain expectations as well as their teams. When drafting issues were taken into account the following rules:

1. The questions were drawn up according to the criteria of importance. As well as short and precise, so that respondents can answer easily and specifically.

2. Were given the opportunity to discuss key issues with the target audience in order that respondents can penetrate deeper into the problems of the survey, and could give a more correct answer to the questions connected with the problem of the study.

Advantages of survey:

1. High Representativeness;
3. Convenient Data Gathering;
4. Good Statistical Significance;
5. Little or No Observer Subjectivity;

Surveys are ideal for scientific research studies because they provide all the participants with a standardized stimulus. With such high reliability obtained, the researcher's own biases are eliminated.

6. Precise Results.

Disadvantages of Survey:

1. Inflexible Design;
2. Not Ideal for Controversial Issues;
3. Possible Inappropriateness of Questions.

Questions in surveys are always standardized before administering them to the subjects. The researcher is therefore forced to create questions that are general enough to accommodate the general population. However, these general questions may not be as appropriate for all the participants as they should be.

The survey form for captain and stand-by vessels crew:

In drawing up the questions for the team took into account their positions.

Questionnaire captain and stand-by vessel crew

The aim of the survey is to detect technical shortcomings and benefits of stand-by vessels. Thus, the survey results will help improve the safety on Norwegian platforms.

1. Position ________________________________
2. The vessel name____.
3. How long have you been working in a rescue team? ________
4. How long have you been working on this vessel? ________
5. Please, describe the most important advantages of your vessel:

   ____

   ____.
6. Write the name and model of the stand-by vessels in which you worked. Evaluate them on 3 point scale following criteria in comparison to each other. (<u>If the number of vessels more than five select which of the vessel that you think have a high degree of security</u>).

   A. <u>(Example: Stril Poseidon)</u> (The vessel in which you work at the moment).

   B. <u>(Example: Stril Herkules)</u>

   C. <u>(Example: Esvagt Aurora)</u>

Table 8. The criteria of vessels for comparison.

(Source: Author's own compilations).

Technical Requirements:		**A**	**B**	**C**
1. Design requirements:				
a)	Main dimensions			
b)	Engines and propulsions			
c)	Tank capacity			
d)	Deck machinery			
e)	Speed and consumption			
2)	Freeboard and rescue zone			
3)	Climbing and rescue nets			
4)	Navigation equipment's			
5)	Lighting system			
6)	Helicopter winching area			

Equipment requirements:				
1)	Rescue equipment's			
2)	Manuals and documents			
Receiving and caring for survivors:				
1)	Accommodation			
2)	Facilities			
Fast Rescue Craft (FRC)				
1)	Equipping of FRC			
2)	Equipping of the crew			
3)	Stowing, launching and recovery of FRC			
4)	Additional equipment's			
Radio communication				
1)	Internal			
2)	External			
3)	FRC			
4)	Helicopter			

Using above specified questionnaire was conducted the survey of captains and the crew including the first and second shift of the vessels that guard the Norwegian platform. Total number of interviewed persons was 48 and among them were six captains.

The survey results were to find out the following facts:

- Among interviewed persons were captains as well as several members of crew who have worked in all three vessels (ch. 5.2).
- Most of the members of the crew SP and SH before and at the moment working on both vessels (ch. 5.2).

Also in the survey were used 3 point evaluation system.

6. RESULTS AND DISCUSSIONS

6.1 S.W.O.T. analysis of stand-by vessels

As expected in the beginning of the work as a result of the comparative analysis has identified the differences between vessels that have a direct impact on performance. The following was obtained by using data from the comparative analysis (ch. 4.3) to make the S.W.O.T. analysis. In the analysis the same criteria was used in the comparative analysis.

Table 9. S.W.O.T analysis of vessels.

(Source: Author's own creation).

S.W.O.T.	Stril Poseidon	Stril Herkules	Esvagt Aurora
Strengths	1. Small volume of consumption 2. High-speed, 3. There is an additional boat recovery winch, 10 tons. 4. Towing winch 120/250 tons 5. The presence of three rescue boats 6. The presence of two-Fi-Fi II 7200 m3 / h	1. Equipped with a large volume dispersant 2. High-speed, 3. There is an additional boat recovery winch, 25 tons Brake load 75tons Speed 0-120 m / min in two steps	1. Small volume of consumption 2. The presence of15 ton tugger winch 3. 2 pieces of Capstans 15 tons 4.
Weaknesses	1. Small volume of dispersant 2. Capstans only 10 tons 3. Accommodation only 25 persons	1. Large fuel consumption 2. Tugger winch 10 tons 3. Towing winch 120 tons 4. Capstans 15 tons	1. Small volume of dispersant 2. Low speed 3. The presence of only two rescue boats FRB 15C, 33 knots, 15 persons 4. Towing winch 100 tons
Opportunities	1. Opportunities of technology development. 2. The demand in the market. 3. The introduction of new requirements and to strengthen standards.		
Threats	The deterioration of the economic situation.		

According to the analysis of the vessel, the individual criteria has advantages that surpasses its analogues. General indicators has identified the vessel having an advantage over the rest of the vessels consideredion this work.

This is the SP wich was built by Aker Langsten for owner Simon Møkster Shipping in Stavanger, This is the vessel which we took as the starting point for the analysis,.

6.2 Assessment survey of captains and vessels crew

The survey has identified the following facts:

1. It was found that the two captains of the respondents as well as 8 members of the crew have worked in all three vessels.
2. Three of the captains and 20 members of crew worked on the vessels SP and SH.
3. 5 members of crew worked in the vessels SP and EA.
4. 3 members of crew worked in the SH and EA.
5. On average the work experience of those surveyed is 2 years.

In the Table 10, SP versus SH versus EA section there are the results of survey of captains and crew members who worked on all three vessels.

The results of the survey of three captains and 20 members of crew who worked on the SP and SH are shown in Table 10 section SP versus SH. Table 10 also shows the results of the survey of 5 members of crew worked on the SP and EA.

Also in the appropriate section of Table 10 shows the results of the survey of 3 members of the crew who worked on SH and EA.

Table 10. Findings of survey of captains and vessel crew.

(Source: Author's own description).

Criteria		SP vs SH vs EA			SP vs SH		SP vs EA		SH vs EA	
		SP	SH	EA	SP	SH	SP	EA	SH	EA
Technical Requirements:	Main dimensions	3	3	3	3	2	2	2	2	2
	Engines and propulsions	3	3	3	3	2	2	3	2	3
	Tank capacity	2	3	2	2	3	2	2	2	3
	Deck machinery	3	3	3	3	3	3	3	2	3
	Speed and consumption	3	3	2	3	3	3	2	3	2
	Freeboard and rescue zone	2	2	2	2	2	2	2	2	2
	Climbing and rescue nets	2	2	3	2	2	2	2	2	3
	Navigation equipment's	3	3	3	3	3	3	3	3	3
	Lighting system	2	2	2	2	2	3	3	2	2
	Helicopter winching area	3	3	3	3	3	3	3	3	3
E R	Rescue equipment's	3	2	3	3	2	3	2	2	2
	Manuals and documents	2	2	2	2	2	2	2	2	2
R C	Accommodation	3	3	3	3	3	2	2	3	3
	Facilities	3	3	3	3	3	2	2	3	3
FRC	Equipping of FRC	3	2	2	3	2	3	2	2	2
	Equipping of the crew	2	2	2	2	2	2	2	2	2
	Stawing, launching and recovery of FRC	2	2	2	2	2	2	2	2	2
	Additional equipment's	2	2	2	3	2	2	2	3	3
Radio C.	Internal	3	3	3	3	3	3	3	3	3
	External	3	3	3	3	3	3	3	3	3
	FRC	3	3	3	3	3	3	3	3	3
	Helicopter	3	3	3	3	3	3	3	3	3

As you can see by the result of a survey of vessels in general indicators the SP is the lead vessel, in second place is the EA and the third is SH.

It is important to note that by the results of survey SP has advantages in both the Rescue equipments and Equipping of FRC.

Based on the results of analysis and survey, it can be assumed that with the use of the vessel SP the level of guard of platforms increases. This suggests that in the case of emergency operations SP will provide more results.

7. CONCLUSION

The quantitative findings of this study made among the stand-by vessels displayed in the literature viewed. Local and individual conditions were not commented in the viewed literature in particular. Such conditions must be considered in each case individually, and those presented in this study are only valid for the vessels in the viewed literature.

However, the conclusion was that the vessel Stril Poseidon has advantages over their analogues, as well as in emergency operations. Its effectiveness will outperform the vessels Stril Herkules and Esvagt Aurora.

Development of stand-by vessels has not solved itself. Its need levers such as the HSE, SOLAS standards, ISM certification, which will ensure the safety of workers and the Environment, if the purpose of the use of multifunctional stand-by vessels are HSE.
This concludes the study of the stand-by vessels used in the guard of Norwegian platforms. In accordance with the scale of oil production and variety of the stand-by vessels, these three vessels represent only a small part of all the actors and the activities performed in the North Sea. These activities form a basis for potential or future in-depth studies. The opportunity of studying the different types of stand-by vessels on wider scale must be seen as an asset, both for the platforms owners, as well as to future students.

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