

## Conference Paper

# The Optimization of Dynamic Positioning Equipment in Operating Remotely Operated Vehicle (ROV) To Eliminate Hazardous Risks in Motor Vessel of SMS Supporter

Moh. Aziz Rohman

Nautical Department, Semarang Merchant Marine Polytechnic, Singosari 2A Semarang 50242, Indonesia

## Abstract

SMS Supporter is an Anchor Handling Towing Ship (AHTS) DP 2 vessel that is operated to serve offshore works and designed for underwater surveillance activities. Over time, currently underwater surveyors have been developed into various types, one of which is Remotely Operated Vehicle (ROV). The main objective of this research is specifically observing ROV operations using Dynamic Position (DP) equipment on board. The surveillance activity using ROV is fundamentally different from other surveillances in general. The objectives in this study are focused on the reason behind the necessary option to Optimize Dynamic Positioning Equipment in Operation Ship with Remotely Operated Vehicle (ROV) works and how the officers / Dynamic Position Operators (DPOs) together with crews are working while implementing international regulations and safety company management system when ROV operations are taking place to run optimally while avoid any hazardous risk. In ROV operations, the caterer will prepare all ROV operational equipment. Officers / SDPO will analyze the various hazards that may occur during ROV operations using DP equipment. The analysis was carried out based on the provisions of the International Marine Contractor Association (IMCA). After corrected completely, the officer / SDPO conduct a Risk Assessment of all activities that will be carried out on board of the vessel while staying mobile, launching and recovering the ROV also when the ROV operation is running. After that, the optimization process in ROV activities using DP equipment on board is done by internal strategic factors analysis summary (IFAS), external strategic factors analysis summary (EFAS), and strength-weakness-opportunities-threat (SWOT) analysis. The strengths and opportunities which they have are used to overcoming weaknesses and threats. SWOT analysis will produce some strategy in Optimalization Dynamic Positioning Equipment In Remotely Operated Vehicle (ROV) Work Operation To Eliminate Risk of Danger at Motor vessel SMS Supporter.

**Keywords:** Operations, Remotely Operated Vehicle (ROV), Dynamic Position (DP) equipment, hazardous risk, risk assessment, IFAS, EFAS, SWOT.

## 1. Introduction

Oil and gas mining industry, especially the offshore industry exploration sector in its operation is in a desperate need of Support vessels. Vessels that are able to work

Corresponding Author:  
Moh. Aziz Rohman  
azizpipsmg@yahoo.co.id

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and operate dynamically in terms of motion and perform special tasks include: Diving Operation, Pipe / Cable laying Operation, Remotely Operated Vehicle (ROV) Operation, Platform Maintenance Operation even to serve and support Drilling work as well as Rig jack-up also requires ships as such, which later is known widely as DP (Dynamic Positioning) Vessels.

The DP equipment in ROV operation activities on ships operated by a DPO must refer to the standard procedures on board, to produce optimal operations in a regard to smooth operation of the ROV and safety of the vessel. Sufficient specific knowledge and skills must be owned by SDPO and another JDPO in the operation. The knowledge gained can come from the literature sources on the ship and can also come from learning applications on the computer. The skills can be acquired from training and hands-on experience about the operation of the DP in supporting the ROV operation.

Among various problems that construct the problem, the ones which will be discussed in this study are:

1. Why do you need to optimize DP equipment to support the ROV operation?
2. How do the officers / SDPO work in implementing the Standard Operating Procedure of the company when ROV operations are run optimally and avoiding the risk of danger?

## 2. Literature Review

Literature review is carried out by the author to understanding the contents of the research. The explanations obtained in this chapter were obtained by the author from reference books that can be trusted as references and can provide a deeper understanding of the research material being discussed.

### 1. Optimization

According to the *Kamus Besar Bahasa Indonesia* (KBBI) optimization is a process, a way, making optimizing or making the best and highest.

### 2. Dynamic Positioning Equipment

Is a device that in its control can maintain and change the position and direction (motion) as desired. DP ships are equipped with a computerized system that works automatically with assist from Thruster, Sensors, position reference system or the PRS, wind sensors, ship enforcing sensors or Vertical Reference Sensors (VRS) and gyro compass (gyro compass) where the above tool works to provide information directly to the recipient's computer data about the position of the ship,

the magnitude and direction of external weather pressures (wind, currents and waves) that cause an influence on the position of the ship.(www.imca-itn.com).

### Basic Forces and Motion

**Three degrees of freedom**

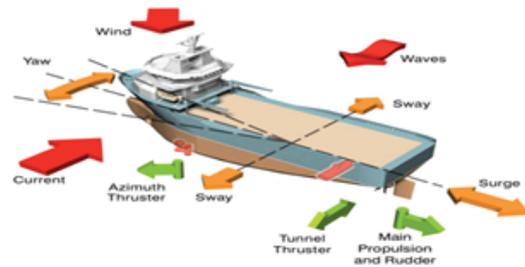
- Surge
- Sway
- Yaw

**Environmental Forces**

- Wind
- Waves
- Current

**Thruster Forces**

- Tunnel thrusters
- Azimuth Thrusters
- Propulsion/ Rudders



### 3. Remotely Operated Vehicle (ROV)

Is a tool that can be controlled by the Pilot ROV in the control room and used to obtain underwater survey data (Freespand correction, Grootbag, Tie in and so on).(www.imca-itn.com).



### 4. Hazardous risk

Risk is a situation that cannot be avoided and always exists in the life of every human being. It is present in everyday life, public or private organizations. Depending on the context, there are many understandings that can be accepted from the use of the word risk, such as in insurance, companies and technical causes.

The general concept in all sense of risk is the uncertainty of an effect that occurs. Risks are divided into how the characteristics of the consequences. Some explain that risk has a detrimental impact, when other impacts are neutral. (Heinz-Peter Berg, 2010).

### 3. Methods

Scientific research consists of two important words. First, research which means observing activities, searching data and evidence in the field or tracking information, both literature / documentary information and causal information. Second, scientific meaning based on theory or based on scientific principles by testing the validity of the data that has been discovered and being observed. If the test results show consistency between theory and reality, the results are considered as scientific. (Afifuddin and Saebani, 2012: 32)

In writing of this research, author will use research methods that can be used to analyze and discuss the problems found from the factors and data available so that the conclusions needed are:

1. The Process of Assessing Hazardous risks

Identification of hazards and their assessments can be simple or complicated, depending on the circumstances. The form of ROV operation activities that are related and the complexity of the handling system will regulate the level of complexity of the hazard assessment and the documents involved in it.

2. Identification of Hazards

All hazards and risks involved in the operation of the ROV are harmful to humans, possession, and the environment can arise due to the nature of the work they're in. These things need to be identified and after that are assessed by making estimates of the possibilities and consequences of existing hazards

3. Assessment of Hazardous risks

Hazardous risk assessment needs to be carried out for each hazard that can be identified from each operation using DP equipment. This will be important in deciding what regulatory actions are needed to ensure that the risk of harm from the ROV operation's work is at an acceptable level. The assessment of hazardous risk will be prioritized upon its importance from the application of hazardous risk regulation that can be carried out by the DP operator.

4. Hazardous risk Management Actions

A consideration is needed to determine the risk of mitigation measures, systems or procedures that are needed to minimize the risk of danger to an acceptable level. When choosing a regulatory action, the aim of this is to get a level that is acceptable from a risk of danger. (Dangerous Safety Guidance Note, 2013).

## 5. SWOT analysis

SWOT analysis is a systematic identification of various factors to formulate a strategy to achieve an optimal outcome. This analysis is based on logic that can maximize strengths (strengths) and opportunities (opportunities), but simultaneously can minimize weaknesses (weakness) and avoid threats (threats). The strategic decision-making process is always related to the development of mission, goals, strategies, and company policies. Thus, strategic planning must be analyzed upon the strategic factors of an object (strengths, weaknesses, opportunities, and threats) in existing conditions. This is called situation analysis. The most popular model for situation analysis is the SWOT analysis. (Rangkuti, 2014)

### 3.1. The technique of data analysis

According to Rangkuti (2014: 15) the most important activity in the analysis process is understanding all the information contained in a case, analyzing the situation to find out the issue of what is happening, and deciding what action should be taken immediately to solve these problems.

#### 1. Internal Strategic Factors Analysis (IFAS)

These are internal factors that have an influence on the formation of strengths and weaknesses. In the existing factors there are assessments needed in the current conditions (weight) and the importance of handling them (rating).

#### 2. External Strategic Factors Analysis Summary (EFAS)

These are external factors that have an influence on the formation of opportunities (opportunities) and threats (threats). In the existing factors there are assessments needed in the current conditions (weight) and the importance of handling them (rating).

#### 3. SWOT matrix

The tool used to compose the strategic factors of an object is the SWOT matrix. This matrix can clearly describe how the external opportunities and threats faced by an object can be adapted to its internal strengths and weaknesses.

## 4. Result and Discussions

Data analysis in this problem analysis section will use a hazardous risk assessment which consists of identifying hazards, assessing hazardous risk, and managing hazardous risk. After that in order to obtain optimal results from the loading process of hazardous liquefied chloride in tank containers, it eliminates the risk of danger, so an internal analysis of strategic factors analysis (IFAS), external strategy and fundamental analysis (EFAS) are needed, and finally a combined analysis is conducted in the strengthweakness opportunity community (SWOT) analysis.

TABLE 1: Initial Assessment of Hazardous risks.

No	Hazard	Effect from	Existing Regulatory Arrangements and Safety Protection	Initial risk		
				(F)	(C)	(F x C)
	<b>Identification</b>	<b>Hazard</b>				
1	Mobilize personnel & equipment from shore base to worksite	Vessel hits other boat, fishing trap or fisherman.	Ensure the navs Are in good condition. b) Spot light area in good condition. c) Ensure horn of vessel in good condition. d) The vessel operated by undedicated helmsman or master	F5	C2	M
2	ROV launching /recover	Loss material / loss time, ROV damage, ROV loss & Propeller damage.	a) Monitor weather forecast, Pre- meeting with all parties. b) ROV to be launch at left side. c) Certified & experience ROV Pilot, d) Communication between DPO & ROV Pilot.	F4	C3	H
3	ROV Operation	Personal injury & death fatality, ROV hits vessel side, ROV umbilical cable are twisted by ship propeller, Under Keel Clearance, Collision with other Vessel or platform facility, DP loses power	a). Monitor weather forecast; wind speed max 20-25 knots, wave 2-2,5 mtrs, current 2 knots. b) Pre- meet with all party. c) Certified & Experince ROV Pilot is required. d) DPO keeps monitoring ROV position. e) UKC is not less than 13 meters, monitor Echosounder. f) minimum watchkeeping consists of 2persons, broadcast security message to all ship in vicinity. g) Inspection of DP system.	F2	C4	H

According to the initial hazardous risk assessment table, in identifying the dangers of the ship being hit by another ship, crashing into nets and fishing boats resulting in losses to the ROV device. Existing regulatory actions and safety protection carried out by the ship is by checking navigation devices such as Automatic Identification System (AIS),

Radar, Navtex and so on that are to be in good condition, updating maps, checking lights and flutes and of course the ship must be operated by an experienced skipper during the operation. Then as a result of risk assessment the danger is frequency F5 (frequent), then consequence C2 (minor), and the results of the assessment are M (medium). This shows that existing activities or events have a level of risk of danger that can still be tolerated. Activities can still be carried out but by paying attention to special notes. More extra supervision is necessary for smooth and safety during activities.

Based on the results of the hazardous risk assessment that has been carried out before the activity takes place, the existing hazardous risk regulation measures are:

TABLE 2: SO Strategy Results from SWOT Analysis.

No.	SO Strategy
1	Implement and apply all existing regulations strictly
2	Combine all vessel facilities and ROV equipment available
3	Improve expertise and experience for existing jobs
4	Carry out guard duty during the ROV operation properly and pay attention to matters that need special handling
5	Maximize performance when the weather supports

The table above presents the things that are the results of the analysis of the factors that are in strength (strength) and opportunity (opportunity). Existing power is used as a driving factor to achieve an optimal process. The factors in strength come from inside the ship. On the other hand, opportunities that come from outside can be used as additional support to achieve a more optimal ROV operation process on board. The results of this strategy generally have a relatively high value.

TABLE 3: ST Strategy Results from SWOT Analysis.

No.	ST Strategy
1.	By strictly adhering to company SMS, the risk of danger in work can be eliminated or avoided
2.	By maximizing the equipment and workforce available, all work including those that have risks can be handled properly
3.	By using a skilled and experienced ship's workforce, the risk of danger can be overcome properly
4.	The existence of a regular and tight service system makes it easier to identify and handle problem
5.	With the maximization of the use of ship equipment, DP equipment that has been recognized with an international certificate then the work can be done

The table above describes the things that are the results of an analysis of the factors that are in strength (strength) and threat (threat). Existing strengths can be used to overcome various threats from outside the ship. Then, another effort to achieve an

optimal outcome is by reducing or reducing the level of threats or impacts from existing threats when carrying out the operation of the ROV activities on board.

TABLE 4: WO Strategy Results from SWOT Analysis.

No.	WO Strategy
1.	Provide more understanding of the work in accordance with applicable regulations
2.	In communicating, we can use international language or visual language that are equally understood
3.	Increasing cooperation and awareness between the workforce of the ship on duty
4.	Maximize supervision by reducing activities that need less to do
5.	Make the most of the available time to understand the most important things in the job

The table above presents the things that are the results of the analysis of the factors that exist in weaknesses and opportunities. The weakness factors that come from inside the ship can be handled by the opportunities that come from outside. By maximizing the opportunities that are well owned, the adverse effects of weaknesses on the ship can be further reduced along with maximizing the opportunities that are carried out. With the reduction of adverse factors, the optimization of ROV operations with DP equipment carried out on board can be achieved well and the risk of existing hazards can be minimized and avoided.

TABLE 5: WT Strategy Results from SWOT Analysis.

No.	Strategy WT
1.	Provide more training on work that is not yet understood, especially related to ROV operations
2.	Provide an understanding of work with language, sign or labels that are understood internationally
3.	Increase awareness and knowledge about the risks of existing hazards
4.	Reduce activities that are less important and increase focus on activities that have a higher risk
5.	Trying to spend more time discussing all the important concerns that can affect the outcome of a job

The table above describes the things that are the results of the analysis of the factors that are in weaknesses and threats. Given the weaknesses and threats in the ROV operation if it does not immediately get good treatment, it can make the results of the ROV operation using DP less optimal. Optimization efforts that can be done are by avoiding, reducing and handling factors that can become weaknesses and threats as early as possible.

The table above shows the percentage of assessment for factors in the SWOT analysis. The data above shows that the percentage of strength weight is 66%, weakness 34%, opportunity 62%, and threat 38%. IFAS's weighted score is 2.75 and EFAS is 2.94.

TABLE 6: Table of Percentage of SWOT Analysis.

Categories	Factor Analysis	Weight Percentage	Weight Score	Percentage
IFAS	Strength	66%	2.75	48%
	Weakness	34%		
EFAS	Opportunity	62%	2.94	52%
	Threat	38%		
TOTAL			5.69	100%

Then for the total percentage owned by IFAS is 48% and EFAS is 52%. With reference to the total percentage, IFAS must be further upgraded so that it can reach a value of 50% or balanced with EFAS. With this balance achieved, the ROV operation activities using more optimal DP equipment can be done. In the IFAS itself, the weakness factor has a small percentage. With the continuous improvement on weakness factors, an optimal process can be achieved.

TABLE 7: Total Weight of SWOT Strategy.

FACTORS	WEIGHT	STRATEGY	STRATEGY WEIGHT SUM
Strength	18.2	SO	35.8
Opportunity	17.6		
Strength	18.2	ST	29
Threat	10.8		
Weakness	9.4	WO	27
Opportunity	17.6		
Weakness	9.4	WT	20.2
Threat	10.8		

The table above shows the weighting of the factors in the SWOT analysis. Then by grouping the existing factors, we obtained SO, ST, WO, and WT strategies. By summing up the factors in the existing strategy, the number of weights obtained for each strategy is generated. By obtaining data on the number of weights for each strategy, illustrating the direction of the tendency of the SWOT strategy can be done. It can be seen that the strategy that has the highest value is the SO strategy with a value of 35.8, while the ST strategy with a value of 29, the WO strategy with a value of 27 and the WT strategy with a value of 20.2. SO strategy contributes to the results with the highest number of weights, while the WT strategy is the least. Therefore, by referring to the order of the number of existing strategies, the strategy that must be addressed first in order to optimize the ROV operation using DP equipment to eliminate the risk of danger in the

SMS Supporter is the WT, WO, ST strategy, and the last is SO. A strategy with a large value indicates that the results are good enough

## 5. Conclusion

The conclusions in the research on the optimizing Dynamic Positioning Equipment (DP Equipment) in the Remoted Operator Vehicle (ROV) Operation work to eliminate the risk of danger in the SMS Supporter ship are as follows:

The reasons for the need to optimize the optimization of Dynamic Positioning Equipment in the Remoted Operator Vehicle (ROV) Operation work to eliminate the risk of danger in the SMS Supporter ship are:

1. Lack of understanding of the operation of DP equipment in ROV operations, the possibility of negligence in handling the operation of DP equipment in ROV operations and related documents, to comply with the regulations and provisions in the IMCA and Standard Operating Procedures of the company procedures.
2. ROV operation is a dangerous type of activity that requires special handling to avoid the risk of hazards that can threaten the safety of the ship, humans and the environment
3. To maximize the performance of the ship and its workers in accordance with IFAS, EFAS, and SWOT.

The efforts of officers and crew in applying international provisions and the Standard Operational Procedure of the company when ROV operations with DP equipment to run optimally and avoid the risk of danger are:

1. Ensure that documents relating to DP and ROV are updated.
2. Increase knowledge, awareness and skills of officers (DPO, JDPO) and crew about handling ROV operations through safety induction for these activities.
3. Implement the results of the strategy from the SWOT analysis that has been carried out, namely with the strategy of WT, WO, ST, and SO.

Suggestions in optimizing Dynamic Positioning Equipment in the Remoted Operator Vehicle (ROV) Operation work to eliminate the risk of danger in the SMS Supporter ship are:

1. In order for all officers (DPO and JDPO) and crew to try to understand the regulations and provisions that exist in the IMCA and Standard Operating Procedures of the company.
2. In order for the skipper to actively carry out training and simulation handling emergency situations handling ROV operations to improve the skills of all ship officers and workers.
3. In order for all officers and ship workers to carry out guard duty when ROV activities are maintained, they should have full responsibility, be sensitive to the situation that is happening and be responsive in handling the problems that exist.

## References

- [1] Affiuddin dan Saebani. B.A. 2012. *Metodologi Penelitian Kualitatif*. Bandung: Pustaka Setia.
- [2] Captain David Bray FNI, 2008. *DP Operator's Handbook*.
- [3] *Convention on The International Regulations For Preventing Collision At Sea, 1972*, Consolidated Edition 2003
- [4] Emzir. 2012. *Metodologi Penelitian Pendidikan Kuantitatif & Kualitatif*. Jakarta: P.T. Raja Grafindo Persada.
- [5] IMCA (International Marine Contractor Association) M 117, 2016, The Training and Experience of Key DP Personnel.
- [6] IMCA (International Marine Contractor Association), 2009, International Guidelines for The Safe Operation of Dynamically Positioned Offshore Supply Vessel.
- [7] Mulyana, Deddy, 2008. *Metodologi Penelitian Kualitatif*. Bandung: P.T. Remaja Rosdakarya.
- [8] Nasehudin, T.S. dan Gozali, N. 2012. *Metode Penelitian Kuantitatif*. Bandung: Pustaka Setia.
- [9] Participants' Manual. 2011. *Handling Dangerous Goods in Ports – General Awareness*.
- [10] Purwanto dan Sulistyastuti. 2007. *Metode Penelitian Kuantitatif untuk Administrasi Publik dan Masalah-masalah Sosial*. Yogyakarta: Gaya Media.
- [11] Rangkuti, Freddy. 2014. *Analisis SWOT Teknik Membedah Kasus Bisnis*. Jakarta: P.T. Gramedia Pustaka Utama Kompas Gramedia Building.