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SIMULATION MODEL OF THE ASSIGNMENT TO SUPPORT OF SEA OPERATIONS IN COMMAND OF THE FLEET II

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ABSTRACT

Scheduling of Indonesian Warship Assignment is Operation Presence at sea by Indonesian Warship to carry out security duties at sea based on time. Security threats and violations at sea in the form of theft of fish, timber and other natural resources and violations of territorial boundaries by foreign vessels require the presence of Indonesian Warship for security.The limited number of Indonesian Warship and the budget provided by the state as well as the need for securing the vast sea area of the Republic of Indonesia in the need for thought about the Indonesian warship assignment model.The purpose of this research is to get the best alternative in order to optimize the scheduling of the Indonesian Warship assignment plan in order to produce a ship movement schedule in this case made by SOPS.Indonesian Warship is used in modeling as many as 52 Indonesian Warship to 17 operating sectors .This method of scheduling research attempts to develop an optimization model by applying the Integer Linear-Zero One Programming method.by identifying decision variables, establishing objective functions and identifying constraints. The results of the assignment model simulation in the form of the composition of Indonesian Warship assignment to 17 operating sectors with a maximum coverage area reached is 65,130,362.68, scheduling Indonesian Warship assignments carried out over a period of 1 year, there is also an increase in Coverage Area of 12.16% from real conditions.Simulation of this assignment model can be used as a consideration in the decision making of the TNI Al Leadership about the assignment of Indonesian Warship in the operations sector, so that it can be implemented / applied in the future.

Keywords: *The Fleet Command II (Koarmada II), Indonesian Warship, ILP-Zero One Programming.*

1. INTRODUCTION

Geopolitically, Indonesia is a country that is located in a strategic cross position in the world, namely at the intersection of the Pacific Ocean and the Indian Ocean and is located between two continents, namely Asia and Australia. Regional maritime security in general is still vulnerable, this condition is proven by the existence of illegal activities in Indonesian waters. Currently there are several agencies that have the authority to maintain security at sea (Kamla) including the Indonesian National Navy (TNI AL), Water Police (Polair), Maritime Security Agency (Bakamla), Customs and Excise (BC), Ministry of Maritime Affairs. and Fisheries (KKP), and the Directorate General of Sea Transportation. Each of these agencies has the authority to assign at sea. Based on Law Number 34 of 2004 Article 9 letter b concerning the Indonesian National Army (TNI), the Indonesian Navy (TNI AL) is tasked with enforcing the law and maintaining security in the marine area of national jurisdiction in accordance with the provisions of national law and ratified international law. Security and law enforcement in the vast territorial jurisdiction of Indonesian waters, carried out by various maritime stakeholders in accordance with their respective fields. One of these tasks is carried out by the Indonesian Navy, which in covering territory throughout Indonesia is divided into 3 Fleet Commands, namely Fleet Command I (Koarmada I), Fleet Command II (Koarmada II) and Fleet Command III (Koarmada III). Fleet Command II (Koarmada II) is the Main Operations Command (Kotama Ops) in the implementation of the implementation of the Main Tasks of the Navy, both in carrying out Marine Security Operations and Marine Combat Operations in the work area of Koarmada II.

The implementation of the Koarmada II operation in this case the Operations Staff (Sops) of the Koarmada II which regulates the planning of the Indonesian Warship assignment is still adjusted to the needs of the number of personnel based on the type of operation to be carried out as stated in the Operational Plan (RO) issued by the TNI Headquarters and the Operational Plan (RO). issued by Pangkoarmada II by coordinating with the Logistics Staff (Slog) of Koarmada II regarding the readiness of Indonesian Warship elements. With the limited number of Indonesian Warship that are ready for operation and the types of Indonesian Warship whose main functions and duties are not to carry out security operations and sea combat, several types of Indonesian Warship carry out operations continuously, this causes disruption of the Indonesian Warship Maintenance Schedule (JOP) which has been prepared within a certain period of time. 1 (one) year,

Based on this, the authors consider that mthe current assignment model needs to be reviewed. By re-simulating the Indonesian Warship assignment model, it is expected to find a better solution to utilize the elements of the Indonesian Warship which are ready to carry out operations not only based on the number of personnel needs that are adjusted to the type of operation being carried out but also considering the JOP of the Indonesian Warship. Simulation modeling in determining the number of Indonesian Warship to support assignments at the Second Fleet Command using Integer Linear Programming (ILP) and Zero-One Programming (ZOP) is a method by developing a mathematical model that aims to simulate the assignment of Indonesian Warship in covering 1 (one) operating sector.

2. MATERIALS AND METHODS

Based on the Law of the Republic of Indonesia number 34 of 2004 concerning the TNI, the Navy as an integral part of the TNI, in addition to having the main task of upholding sovereignty (article 7) also has the task of enforcing the law and maintaining maritime security from various forms of threats in the territorial waters of jurisdiction. Indonesian nationality (article 9 LETTERS b). In order to carry out the mandate of the law, the Indonesian Navy has the perception that the sea must be safe from three aspects of threats that cover both dimensions, both sovereignty and law. The three aspects of the threat are the threat of violence, the threat of navigational hazards and the threat of violating the law.

In this study, using the Integer Linear Programming method with a Zero-One (0-1) Programming approach. Linear programming involves planning activities to obtain optimal results, namely the results that best achieve certain goals (according to the mathematical model) among all feasible alternatives. In general, the Integer Linear problem modelProgramming can be formulated in the following example (Sukmana, 2018):

Maximize

Zmax = Cij Xiji $\sum_{j=1}^{n}$

Obstacles

$\sum_{j=1}^{n}$ Cij Xij / = / Bi, j = 1,2,3,…n

Xj 0, j = 1,2,3,…n

Xj integer for j = 1,2,3,..,p(p≤n)

description :

Z max = Reach *Coverage Area* Indonesian Warship

Cj = Value *Coverage* Ship / Indonesian Warship

Xj = Quantity Indonesian Warship (which will be searched).

Cij = coverage area that can be taken while on patrol and the area of water that can be secured by each Indonesian Warship.

Bi = The total number of distances that must be covered in the entire patrol operation and the total area that must be secured by all Indonesian Warship.

3. ANALYSIS AND DISCUSSION

3.1. Assignment Simulation Process Indonesian Warship

In the Indonesian Warship assignment simulation process using the Open Solver Excel program. The completion steps are as follows:

a. Modeling

The preparation of the model begins with inputting the operating sector data under Koarmada II in the form of a picture of the operating sector and a table of the operating sector.The preparation was continued by developing the model by including a zero-one assignment matrix to find out the number of ships to be used and the operating sector to be assigned to the Indonesian Warship. Furthermore, the data on the capability of the Indonesian Warship Coverage Area value is compiled, the Decision Variable matrix, Objective Functions and Constraints, the matrix and achievement coverage are still left blank, later it will contain Zero - one decisions and achievement coverage.

b. program run (*Running*)

travel / *Running*The program starts by entering the previously named data range in the open solver parameter. The data entered are:

- *Set Target Cells* = objective function (*objective function*)
- *By Changing Cells* = decision variable (Decision Variable)
- *Subject to the constraint* = Constraint function
- *Solve* = Program run

c. Program Run Results. The result of running the excel open solver program in this problem is the value of the Objective Function (maximizing the Indonesian Warship coverage area) and the decision variable.

3.2. Research result

Solving the Indonesian Warship assignment model, resulted in an assignment model in the form of the composition of the Indonesian Warship assignment to the operating sector. With the help of open solver software, the results of the Indonesian Warship assignment to the operating sector are as follows:

Table 1. Result of Simulation Model

Kapal	SEKTOR OPERASI																
	A1	A2	A3	B1	B2	B3	C1	C2	C3	D1	D2	E1	E2	E3	ALKI	RE-FUEL	INDONESIAP HI
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
12	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
35	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
43	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
44	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
45	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
47	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
51	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
52	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

The table above shows the zero-one matrix of optimization results for Indonesian Warship assignments in TW I (TW II-IV can be seen in appendix – 3). From the matrix of the optimization results, it can be seen that each operating sector has been covered by the Indonesian Warship with an optimally ready status for operation. In general, the optimization results in maximizing the coverage area of the Indonesian Warship assignment from TW I to TW IV are presented in the following table:

Table 2. Results of optimization of Indonesian Warship assignments

NO	TW	NUMBER OF INDONESIAN WARSHIP AS Assigned	*COVERAGE AREA* (Nm²)
1	I	26	15,685,155.12
2	II	24	13,597,845.29
3	III	22	15,112,317.21
4	IV	33	23350569.65
Total Coverage Area			**68,011,492.14**

Table 2 is a recap of the results of the Indonesian Warship assignment model per-TW to the Koarmada II operational sector within 1 year. Based on the table above, the assignment of Indonesian Warship in 1 year involves 49 Indonesian Warship out of 52 Indonesian Warship in the ranks of the Second Koarmada with a maximum total coverage area of optimization results that can be secured by Indonesian Warship of 68,011,492.14 Nm². (The area of all 14 operating sectors, ALKI II, Indomalphi Field Coordinator and RI-Phil Coordinator is 643.150 Nm²). From the results of per-TW optimization results in the division of Indonesian Warship assignments to the operating sector.

3.3. Verification

At this stage, the last step in the modeling process is carried out, namely carrying out verification. Where verification is done by comparing the results of simulation calculations with the real reality in the field. In 2020 the results of the implementation of maritime security operations and sea combat operations in the Koarmada II area are as shown in the following table:

Table 3. Results of TA Marine Security Operations. 2020

NO	TW	NUMBER OF INDONESIAN WARSHIP AS Assigned	*COVERAGE AREA* (Nm²)
1	I	24	15,021,855.66
2	II	20	11,096,679.33
3	III	25	14,606,776.86
4	IV	34	19,915,121.03
Total Coverage Area			**60,640,432.88**

Table 3 is a data recapitulation of the results of the assignment of the Indonesian Warship operation title in 2020, with an operational coverage area of 60,640,432.88 NM2. During the 2020 operation, there was a composition of assignments that were not evenly distributed in covering the operating sector from both opskamla and opspurla as well as the accumulation of Indonesian Warship in one operating sector which caused the intensity of the presence at sea in several sectors to be not covered / there was no security by the Indonesian Warship.

Table 4. Comparison of Real Conditions with Simulation Results

No	Items Compared	Real Condition (1 year)	Simulation Results (1 year)	Description
1	Area of operation sector	643,150	643,150	You're welcome
2	Coverage Area TW 1	15,021,855.66	15,685,155.12	Up 4.42%
3	Coverage Area TW 2	11,096,679.33	13,597,845.29	Up 22.54%
4	Coverage Area TW 3	14,606,776.86	15,112,317.21	Up 3.46%
5	Coverage Area TW 4	19,915,121.03	20,735,045.06	Up 17.25%
6	*Coverage Area* achieved	**60,640,432.88**	**68,011,492.14**	Ride 12.16%

Table 4 is a comparison of the real assignment with the simulation results of the Indonesian Warship assignment model using ILP. It can be seen that from the simulation results of the development of the Indonesian Warship assignment model in Koarmada II, it shows that the coverage area per TW and coverage area in one year of operation has increased in the implementation of operations that are adjusted to the Indonesian Warship JOP. So with this the assignment model simulation can be used as a consideration for future Indonesian Warship assignments provided that the Indonesian Warship maintenance schedule is carried out in accordance with the predetermined / planned JOP. The assignment model can change from time to time based on increasingor a decrease in the number of Indonesian Warship elements under the ranks of Koarmada II as well as the interests of the operating sector where there is an increase or decrease which affects the needs of the Indonesian Warship in the operating sector.

4. CONCLUSIONS.

The assignment of Indonesian Warship to the Koarmada II operational sector can be simulated using the Integer Linear Programming method. The decision variable is in the form of a zero-one matrix of Indonesian Warship assignment to the operating sector, while the tools to solve it are using the Microsoft Office Spreadsheet Solver program. The output of the assignment model is:

a. Results The assignment simulation obtained is in the form of a composition model for the assignment of 49 Indonesian Warship that carry out sea operations from 52 available Indonesian Warship to the 14 allocated operating sectors plus the ALKI II sector, RI-Phil Patkor and Indomalphi Patkor, the assignment model is simulated perTW for 1 year of operation. With the coverage area achieved is 65,130,362.68 of the entire operating sector (643,150 NM^2), from the simulation results it is also known that there is an increase in Coverage Area of 12.16% from the real condition of the assignment.

b. Other simulation results are in the form of a Indonesian Warship assignment scheduling model and the type of Indonesian Warship that will carry out

operations, which are carried out perTW for a period of 1 year of marine operations adjusted to the Indonesian Warship maintenance schedule, this is an effort to fulfill the concept of Indonesian Warship employing cycle: 1/3 operations, 1/ 3 standby and 1/3 maintenance.

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