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GLOBALIZATION OF INCREASING OF MARITIME EDUCATION LEVEL

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ABSTRACT

Scientific research which has been carried out in Far Eastern State Technical Fisheries University for recent two decades shows the urgency of regular correction of training marine specialists. The conditions that point to the necessity of the correction are fast development of modern navigational methods and requirements of IMO convention.

Theoretical statements used in structural analyses of training of officers for providing marine safety allowed to determine the main ways of improvement of the existing training system. The ways are: automation of production processes, application of computer techniques, special training. As a result of detailed structural analyses of marine educational systems we drew to certain conclusions on the negative aspects of the systems. The negative aspects are as follows:

- lack of unification in training, regular retraining and certification of marine specialists (this can be improved through the activity of marine education centers)
- lack of unification of simulators for certification of marine specialists.

Conclusions and suggestions including the problem of intensification of training process due to application of new techniques and implementation of tariffs for teaching staff are of great interest for the authors.

NOMENCLATURE

Hereinafter we use terms common for international maritime practice, otherwise specified.

In order to avoid misunderstanding we offer the following terms and abbreviations:

1. IMO - International Maritime Organization
2. System graphical research - analysis of structure of certain system with the help of a body of mathematics of graph theory.
3. Top graph - representation of real system in form of blocks (vertexes and elements) and connections (transmission and interactivity) between them.
4. Rib graph - representation of certain scheme as a result of modification of graph. Connections, information, interactivity or functions become vertexes and real and quasi-elements become edges.
5. Navigation - process providing safe sea faring and aiming at achievement of set purposes.
6. Fishing navigation - process providing safe sea faring and influence on parameters of production process carried out on board fishing vessel (motion of vessel, search and harvesting of fishing objects)

7. FSAD - fish searching acoustical devices
8. DSP - determination of ship's position.

SYSTEM APPROACH TO IMPROVEMENT OF QUALITY OF MARITIME TRAINING OF FISHING FLEET NAVIGATORS

Introduction

Eagerness of maritime teaching staff to improve quality of maritime education through its globalization is natural. The quality level is predetermined by requirements of corresponding International IMO Conventions and state standards, curricula, training programs etc. Thus, maritime education goes behind practical needs.

That is why leading scientists and seafarers develop certain potential aspects of development of navigational devices and methods for the subsequent improvement of quality of maritime training. In Russia a great contribution to investigation and increasing effectiveness of navigation was made by Y.K. Baranov, R.B. Brandt, V.V. Veykhman and others. A.I. Rodinov, A.E. Sazonov, Y.N. Fimilov and other authors devoted their studies to automation of navigation and increasing accuracy of navigational information processing. V.V. Konovalov, K.N. Zuyev, M.I. Kogon and other scientists contributed much to development of simulators and imitation devices intended to train navigators. Of certain interest are engineering and psychological studies of navigator's activity and marine safety conducted by E.M. Lushnikov, V.O. Ramm. Technical ideas of A.A. Andreev, L.P. Gostomyslov, A.I. Karapuzov and some other experts aim at solution of navigational tasks at fishing. Fundamental background of complex automated decision making system was laid by M.I. Gabryuk, L.A. Zemnukhov, V.M. Lobastov and O.V. Nemtsev.

Chair of navigation at Dalrybvtuz has carried out system analysis of professional activity, training and its improvement for more than 20 years. A new approach has been developed which allows to formulate requirements to corresponding maritime training programs based on real working conditions at sea. This approach allows to correct educational process with regard to practical needs before they are confirmed by IMO regulations. Distribution of the approach will allow to realize global structure of qualified maritime specialists for fleet vessels.

The present paper contains the task, theoretical studies, ways of practical solution and problems of global approach to fishing fleet navigators.

Theoretical subjects

System approach to investigation of fishing navigation system (FNS) was first applied by the author in 1989 [E.M. Zhidkov, E.N. Malyavin, 1]. The main point of the approach is that every system presents an integrated unity even if it comprises various functional systems and subsystems. Each system has several indicators and relationship between them can vary. System approach methods let us solve two main tasks: determination of system elements value and relationship between them; evaluation of quality of structural scheme of the system and recommendations on its improvement. Thus, solution of these problems would allow to find common approach to improvement of maritime education quality.

The main condition of successful system analyses is usage of adequate system model. For FNS we developed a system model which takes into consideration both functional and probable relations and their interaction in system.

The model can be represented in form of oriented top graph, vertexes of which are formed by FNS elements, and edges are represented by interaction and informational relations in system [V.I. Nechiporenko, 2]. Analysis of such model allows to give recommendations for achievement of the following tasks: 1)

functional unloading of some system elements; 2) strengthening of weak units through functional redundancy; 3) redistribution of efforts in order to achieve the desired quality of system functioning.

For a detailed analysis we have to change from the adopted representation of FNS in form of top graph to rib graph. This shift makes it possible to represent physical parameters of system elements to graph links and to accumulate all the logical conditions in vertexes.

Such method applied to a certain system model is given below in details.

Structural analysis of system of professional activity of navigators.

Professional activity of navigator is carried out in FNS. The model represented herein is based on system analysis conducted by Chair of navigation at Dalrybvtuz in late 60s, observations and experimental data from fishing vessels taken in 70s-80s as well as on theoretical statements and evaluation made by experts.

Top graph of FSN model is given on Fig. 1.

In order to built rib graph equivalent to given top graph we present matrix of influences in the following form:

$$\| l_{ij} \|_1^{11} = \begin{Vmatrix} 1 & & & & & & 1 & & & & \\ & 1 & 1 & 1 & & 1 & & & & & \\ & & & & & & 1 & & & & \\ & & & & & & 1 & & & & \\ & & & & 1 & & & & 1 & & \\ & & & & & & 1 & & & & \\ & & & & & & 1 & & & & \\ & & & & & & & 1 & & 1 & \\ & & & & & 1 & & & 1 & 1 & \\ & & & & 1 & & & 1 & & & \end{Vmatrix} \qquad (1)$$

Based on matrix $\| l_{ij} \|$ (1) and using the quasiconical matrix theorem we build matrixes $\| S_{ij} \|$ and $\| C_{ij} \|$. Elements of matrix $\| S_{ij} \|$ are defined according to formula

$$S_{ij} = l_{ij} \left(\sum_{i=1}^{11} l_{ij} + \sum_{j=1}^{11} l_{ij} \right) \qquad (2)$$

Where $\sum_{i=1}^{11} l_{ij}$, $\sum_{j=1}^{11} l_{ij}$ are sums of units in lines and columns of matrix $\| l_{ij} \|$.

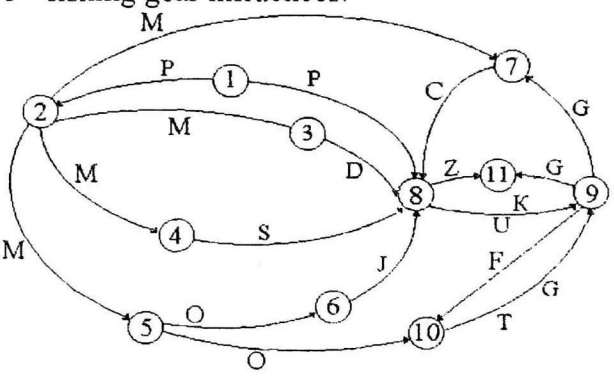
Computing according (2) we obtain matrix as follows:

$$\| S_{ij} \|_1^{11} = \begin{Vmatrix} 3 & & & & & & 7 & & & & \\ & 5 & 5 & 5 & & 6 & & & & & \\ & & & & & & 6 & & & & \\ & & & & & & 6 & & & & \\ & & & & 4 & & & & 4 & & \\ & & & & & & 6 & & & & \\ & & & & & & 6 & & & & \\ & & & & & & & 4 & & 4 & \\ & & & & & 5 & & & 5 & 5 & \\ & & & & 4 & & & 4 & & & \end{Vmatrix} \qquad (3)$$

Fig. 1. FNS top graph

System blocks: 1.- task block; 2.- transit and fishing grounds; 3.- ship's location definition block; 4.- safety block; 5.- fishing object; 6.- fish searching instruments; 7.- other vessels; 8.- navigator; 9.- vessel; 10.- fishing gear; 11.- estimation block

Influences in system: P - voyages task, M - area characteristics, D - current coordinates data, S - current safety estimation, O - influence of fishing object and gear, J - fishing object information, C - information from other ships, Z - given criterion, U - governing influences, K - course, G - cargo amount information (made product), F - influence of vessel on fishing gear, T - fishing gear influences.



Elements of matrix $\|C_{ij}\|$ are calculated based on formula

$$C_{ij} = l_{ij}\left(\Delta_{j/i}S_{ij} + \Delta_{i/j}S_{ij}\right), \quad (4)$$

where $\Delta_{j/i}S_{ij} = \left(S_{ij} - \min_{j} S_{ij}\right)_i$ is sum's excess of data-in and data-out half extents for element l_{ij} in i-line in comparison with element having minimal value $S_{ij}\neq 0$ in this line;

min S_{ij} is minimal data-in and data out half extents sum value for elements $l_{ij}=1$ in i-line;

$\Delta_{j/i}S_{ij} = \left(S_{ij} - \min_{j} S_{ij}\right)_i$ is sum's exceed of data-in and data out half-extents for element $l_{ij}=1$ in j-column in comparison with element having minimal value $S_{ij}\neq 0$ in this column;

min S_{ij} is minimal value of data-in and data-out half-extents sum for elements $l_{ij}=1$.

If to continue calculations we shall define the final matrix as follows:

$$\|C_{ij}\|_1^{11} = \begin{Vmatrix} 0 & & & & & 5 & & & & & \\ & 0 & 0 & 0 & 2 & & & & & & \\ & & & & & 0 & & & & & \\ & & & & & 0 & & & & & \\ & & & & 0 & & & 0 & & & \\ & & & & & 0 & & & & & \\ & & & & & 0 & & & & & \\ & & & & & & 0 & & 0 & & \\ & & & & 0 & & & 1 & 1 & & \\ & & & & 0 & & 0 & & & & \end{Vmatrix} \quad (5)$$

Method of rib graph tops numeration according to [O.Ore, V.I. Nicheporenko, 3] allows to shift to a new rib graph shown in Fig. 2.

Additional symbols for Fig. 2: 12. - fishery strategy choosing block, 13. - FSD information interpretation block, 14. - fishery strategy implementing block, 15. - navigation and ship monitoring block, 16. - fishing object recognition block, 17. - monitoring criterion working-out block, 18.- ship monitoring control block, 19.- influencing factors analyzing block, 20.- optimization block; a - start of system activation, b=P, c=M, d=T, e=G, f=(P,D,S,J,C) - information for ship's navigator, i = information on target function, k - influences of vessel, l - end of activity.

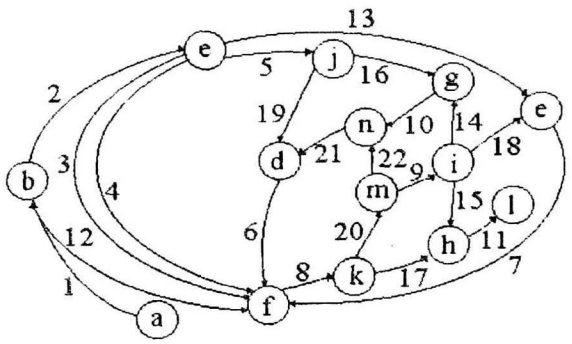


Fig. 2 is equivalent to Fig. 1 as it preserves the same system of binar oppositions. If we connect middle points of ribs of the graph in Fig. 2 we shall get original tops of the graph.

Thus, in accordance with Fig. 2 we have determined group of quasielements which are necessary for improvement of effectiveness of the whole FNS. These groups contain elements represented in Tab. 1

Elements and links of equivalent rib graph Table 1

Tops of the graph (influences, links, FNS signals)		Data-out signals of tops of rib graph (ribs of equivalent graph)	
Mark on the graph	Corresponding data-out signals or their functions	Rib No.	Name of the corresponding element
1	2	3	4
a	Start of system activation	1	Task block

1	2	3	4
b	b=P - voyage task	2 12	Transit and fishing grounds Influencing factors analysis
c	c=M - area characteristics	3 4 5 13	Ship's location definition block Safety block Fishing object Fishery strategy choosing block (FNS quasielements)
d	d=T - fishing gear influences	6	FCD
e	e=G - cargo amount (made product)	7	Other vessels
f	Information for navigator	8	Navigator
g	g=0 - influence of fishing object on fishing gear	10	Fishing gear
h	Influence of navigator	11	Estimation block
i	Information for navigator on target function	14 15 18	Fishing strategy implementing block F_{14} (G,D,O) (FNS quasielement) Navigation and ship monitoring block F_{15} (G,KZ,U) (FNS quasielement) Ship monitoring block at fishing time F_{18} (G,D) (FNS quasielement)
j	j=0 - influence of fishing object on fishing gear	16 19	Estimation block F_{19} (O,T) (FNS quasielement) O interpretation block (FNS quasielement)
k	Governing decision of navigator (U,Z)	17 20	Monitoring criterion working-out block F_{17} (U,Z) (FNS quasielement) Optimization block F_{20} (U,K,T) (FNS quasielement)

1	2	3	4
m	m=T - fishing gear influences	9	Vessel
n		21	Optimization block F_{21} (U,Z) (FNS quasielement)
		22	Optimization block F_{22} (O,T,U,G,F) (FNS quasielement)
l	End of activity		

Shortcomings and methods of improvement

From the above analysis of system of professional activity of navigator we can draw to a conclusion about necessity of its improvement (FNS quasielements) and methods of implementation. The results are included into Tab. 2.

Contents of quasielements and new links in FNS structure — Table 2

Quasielements, new links	Symbols (Fig. 2)	Tasks being solved	Ways of improvement	
			main	Secondary
1	2	3	4	5
1. Regulating factors analysis block	12	Computing ones	Automated system of decision making (ASDM)	Automation of navigation
2. Fishing strategy choosing block	13	Computing ones	ASDM	Training
3. Realization block	14	Technical and computing ones	ASDM	
4. Navigational and ship monitoring block	15	Technical ones	Automation of navigation	ASDM, Automation of ship's control when fishing, training
5. Recognition block	16	Technical and computing ones	Automation of ship's control when fishing	Training
6. Block of monitoring criteria choosing	17	Computing ones	ASDM	Automation of ship's control when fishing
7. Ship's control block when fishing	18	Technical and computing ones	Automation of ship's control when fishing	Training
8. Fishing object and gear interinfluences estimation block	19	Technical and computing ones	Automation of ship's control when fishing	Training
9. Monitoring optimization block	20	Technical and computing ones	ASDM	Automation of ship's control when fishing
10. Optimization of FCD mode	21	Computing ones	Training	ASDM
11. Optimization of vessel and fishing gear interinfluences	22	Computing ones	Automation of ship's control when fishing	Training, ASDM

Tab. 2 analysis shows that FNS improvement which provides required quality of education can be systemized through analysis of FNS subsystem according to the above method.

CONCLUSIONS

Thus in order to drawing criterion of maritime education to the required level we need system approach principles of which are stated above for one of maritime specialties and can be applied to another educational programs.

One of the main results of the analysis in coincidence of investigation research with the requirements of IMO in force at present or being adopted. Besides our approach allows to forecast global requirements to maritime education before they are considered by IMO.

As a result, globalization of improvement of maritime education can be achieved through constant research on the suggested theoretical basis. Moreover, a separate problem in maritime education improvement is lack of worldwide level of maritime teaching staff salaries

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