USE OF HUMAN BIORHYTHMS TO IMPROVE THE WATER TRANSPORT SAFETY MANAGEMENT SYSTEM

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Summary. In the modern world of the transport industry, it is important to implement new technologies and innovations to ensure safety and work efficiency. One of the pages of this challenge is the possible use of biorhythms in shipping companies. This article examines the advantages and disadvantages of such an approach, and also identifies the potential effectiveness of the implementation of biorhythms to increase the level of safety and optimize the operation of maritime and inland waterway transport. One of the key benefits could be the adaptation of crews' work schedules to their natural biological rhythms, helping to reduce the risks of fatigue and errors. On the other hand, there are certain challenges associated with the use of biorhythms in transport, such as individual differences in biological cycles and technical aspects of implementing such systems. In this context, our analysis will highlight different aspects of the use of biorhythms in shipping companies, offering readers a deeper understanding of the opportunities and challenges of this innovative approach to managing the safety and efficiency of water transport.

Keywords. Vessel safety, human biorhythms, management, circadian rhythms, lunar rhythms, reflexology.

Introduction. In the modern world, accident-free operation of the water transport is a dominant importance not only from the viewpoint of safety for human life and health, but also in terms of preserving the ecological stability of external environment. A generally accepted Safety Management System (SMS) plays a key role in ensuring accident-free transportation of goods and passengers of any shipping company [8]. However, at this stage of human history, scientific progress is rapidly developing new technologies for production activities, so it is necessary to look for modern approaches to improving the SMS. In recent years, the management systems of large corporations have shown increased interest in the use of human biorhythms, including lunar, circadian, annual, and ancient Eastern rhythms of reflexology. This article highlights the advantages and disadvantages of the possible
application of the above-mentioned biorhythms in the SMS of shipping companies. It reveals the potential effectiveness of their implementation to improve the safe operation of maritime and inland water transport.

The main research material. Biological rhythms (biorhythms) (from the Greek βίος - bios, “life” [6] and ρυθμός - rhythm, “any repeated movement, rhythm” [7]) are periodically repeated changes in the nature and intensity of biological processes and phenomena. They are characteristic of living matter at all levels of its organization - from molecular and subcellular to the biosphere. They are a fundamental process in living nature.

Some biological rhythms are relatively independent (for example, the frequency of heart contractions, breathing), others are associated with the adaptation of organisms to geophysical cycles, for example, diurnal, tidal, annual. The science that studies the biological rhythms that have arisen in living beings to adapt their life activities to periodic changes in the environment is called chronobiology [10].

Chronobiology (from ancient Greek Χρόνος - “time”) is a branch of biology that studies cyclic processes in biological systems at different levels of organization. In Slavic-language publications the term biorhythmology is also used.

Chronobiological research includes (but is not limited to) work in the fields of comparative anatomy, physiology, genetics, molecular biology and behavioral biology of organisms. Other aspects include the study of development, reproduction, ecology and evolution of species [10].

Biorhythm is a sequence of repeating cycles. A cycle, in turn, is a completed oscillation, a deviation of a certain indicator from the initial value with a return to it after some time. The following characteristics of biorhythms are distinguished:

• Period - the time required to complete one cycle of the process;
• Frequency - the number of repetitions (number of cycles) of a given rhythm over a certain period of time;
• Phase - the moment of the cycle when a certain indicator is recorded;
• Mezor - the average value of a certain indicator;
• Amplitude - the greatest deviation of the indicator from the mesor.

Any biorhythm has two characteristic phases:

• Acrophase - the phase in which the fluctuating value has a maximum value;
• Bathypase is the phase in which the oscillating quantity has its minimum value.

Since the birth of chronobiology, the interests of this science have included the study of those rhythms that arose in living beings to adapt their life activities to periodic changes in the surrounding geophysical environment. These biological rhythms are usually called circarhythms (from the Latin Circa - “about, approximately”), the main ones among them:

• solar diurnal (circadian) - 24 hours;
• lunar-diurnal, or tidal (circatidal) - 24.8 hours;
• lunar-monthly (circalunar) - 29.5 days;
• annual, or seasonal (circaannual).

The largest share of research is devoted to the study of circadian rhythms.

The general meaning of the article is based on the published report of “XIV International Scientific and Practical MODERN APPROACHES TO HIGH-
PERFORMANCE USE OF VEHICLES" (DI NU "OMA" - 2023), which was held on December 8-9, 2023 at Izmail, Ukraine. It expands the author’s theses included in the report.

Thesis 1. The influence and application of lunar rhythms. The Moon influences various natural phenomena and aspects of life on Earth, including the physical and emotional state of a person. This influence is similar to the phenomena of ebb and flow in different parts of the world depending on the position of the Moon at different times. The strength of its influence on water levels is illustrated by the example of the p. Townsend in Washington State (See Pic. 1.)

Research shows that Lunar rhythms affect not only the natural environment, but also sleep, mood, concentration and human reactions, especially in states of stress. Different phases of the Moon can cause changes in a person’s biorhythms, which significantly affects his performance and alertness. The most common scientific and medical model of these influences is the concept of four biorhythms: physical (around 23.7 days), emotional (around 28.5 days), intellectual (around 33.2 days) and intuitive (around 37.5 days) [9]. There are many computer programs that allow you to monitor the individual activity of their states at any point in time. An example proposed the one interface of program “Queensoft Byorithemes Expert” [9]. It is shown in Pic. 2.

At the same time, at the end of the 20th century, the pseudoscientific theory of “three rhythms”, independent of both external factors and age-related changes in the body itself, gained popularity. The theory was proposed by a number of authors at the end of the 19th century as a hypothesis and was later experimentally refuted [3][4][11]. The hypothesis assumed the presence of multi-day rhythms, independent of both
external factors and age-related changes in the body itself. The triggering mechanism for these rhythms is only the moment of birth of a person, at which rhythms arise with a period of 23, 28 and 33 days, determining the level of his physical, emotional and intellectual activity. The graphical representation of each of these rhythms is a sine wave. One-day periods during which phase switching occurs ("zero" points on the graph) and which are supposedly characterized by a decrease in the corresponding level of activity are called critical days. If two or three sinusoids cross the same "zero" point at the same time, then such “double” or “triple” critical days were supposed to be especially dangerous. This hypothesis has not been confirmed by scientific research and is based on unsystematic empirical observations.

Anyway, the use of Lunar rhythms can help to more accurately determine the optimal periods for training, rest or performing the most dangerous work on the ship and in ports according to the upgraded SMS. These have several aspects:

Firstly. It allows to analyze data on the condition of personnel and passengers taking into account the phases of the moon. For example, during the full Moon, when levels of physical activity and emotional arousal are increased, additional precautions can be taken and additional control over the safety of work activities will be done.

Secondly. A work schedule could be developed by own staff that takes into account the strengths and weaknesses of each employee. This will really reduce the risk of erroneous actions and the occurrence of accidents associated with physical and emotional fatigue.

Thirdly. The Lunar rhythms could be used for optimization of the process of crew training, i.e. providing them with the necessary knowledges and skills during optimal periods of their intellectual activity.
Thesis 2. The influence and application of circadian (daily) rhythms. In addition to the Lunar rhythms, there are also daily (circadian) rhythms, which regulate the body's biological processes over a 24-hour period. The patterns could be used into determining the most effective time intervals for conducting safety inspections and maintenance of critical equipment on a board.

There are rhythms that everyone can follow. A typical example: no one feels as energetic in the evening as in the morning. And it doesn't matter whether you're a morning person or a night owl. But the level of activity of these rhythms at the same time is different for everyone. Therefore, it is advisable to take into account the individual characteristics of all team members in order to optimize their work schedule to ensure maximum performance of all personnel.

There are many hypotheses about one of the main mysteries of the human body - the internal biological clock. One of them imagines the activity of our body as follows (See Pic.3):

The 1st hour after midnight: Most people sleep for about three hours, going through all stages of sleep. Now the light sleep phase begins, we can easily wake up. We are very sensitive to pain during this period of time.

The 2nd hour: Most internal organs have slowed down. Only the liver uses the rest period for more intense metabolism, removing all toxic substances from the body. A “great cleansing” is taking place in our body this time. Those who are still awake should not drink coffee, tea or alcohol. It is better to drink a glass of water or milk.

The 3rd hour: Our body is resting. If you must stay awake, try not to be distracted and focus completely on your work. At this time period, blood pressure is lowest, pulse and breathing are the slowest.

The 4th hour: The pressure is still low, and only a minimal amount of blood reaches the brain. This is the dangerous time, when the most people die. The body works at minimum speed, but hearing becomes more acute. Even the slightest noise wakes us up.
The 5th hour: The kidneys are resting; urine output is minimal. Several times already we have gone through all phases of sleep - from light sleep through the dream phase to deep dreamless sleep. Anyone who gets up at this time quickly becomes excited.

The 6th hour: The pressure increases, the heart beats faster, the blood pulsates. The body awakens, even if we still want to sleep.

The 7th hour: The body's resistance is especially strong. When encountering viruses and bacteria at this time, you have the greatest chance of avoiding infection.

The 8th hour: The body has rested; the liver has removed all toxins. Under no circumstances should you drink alcohol at this time; this will extremely overload the liver.

The 9th hour: Mental activity increases, pain sensitivity decreases. The heart is working at full speed.

The 10th hour: Our activity increases and we are in the best possible physical state. “We can move mountains and crush rocks”. This energy will not subside until lunchtime. Conversations over coffee at this time are a waste of your own energy potential.

The 11th hour: The heart works rhythmically in accordance with our psychological activity. We don’t feel much overload.

The 12th hour: All our forces are at the ready for physical actions. You should not eat much at this time; it is better to wait another hour for lunch.

The 13th hour: The liver rests, and less glucose enters the blood. The first period of daytime activity has passed. You feel tired and in need of rest.

The 14th hour: The energy curve is going down; our reactions are getting slower. This is the second lowest point in the daily cycle.

The 15th hour: Our health has improved again. The senses, especially smell and taste, are especially sensitive. Gourmets sit down to the table at this hour for the best satisfaction of meals.

The 16th hour: Blood sugar levels increase. This does not mean illness; it will go down again very soon.

The 17th hour: Our productivity is still high. At this time, athletes train very intensively.

The 18th hour: We are sensitive to pain again. But the feel of needs be moving are high, so mental activity gradually decreases.

The 19th hour: Blood pressure increases, we become nervous, and quarrels easily arise over trifles. This is a bad time for allergy sufferers. Your head may hurt some time.

The 20th hour: Our weight reaches a daily maximum. Reactions are unusually fast. Drivers are in good state and the fewest traffic accidents at this time are present.

The 21st hour: Our mental state has stabilized again. This time is favorable for students and actors to memorize texts or roles, as memorizing capacity increases in the evening time.

The 22nd hour: The number of white cells in the blood increases from 5-8 to 12 thousand. Body temperature decreases.

The 23rd hour: Our body prepares for sleep, but continues to renew its cells.
**The 24th hour:** If we have been sleeping for two hours, then right now we may dream of something good. Throughout our entire body, and, consequently, in the brain, balance is established and everything unnecessary is removed. Have pleasant dreams and a cheerful awakening in the morning!

**Thesis 3:** The influence and application of annual rhythms. The annual period is the most important thing in our lives, determined by the solar cycle. But not the one that starts on January 1, but another one. Each of us has our own New Year holiday - this is our birthday! On the given day of any year, the Sun returns to the place in a circle of the Zodiac from where it began its journey at the moment of your birth. Circle by circle, the next biological year is counted from it - from the birthday to the next birthday. Let’s divide this bio-year into 12 periods. For example, if you were born on March 8, the first biological month is from March 8 to April 7, the second is from April 8 to May 7, and finally the last, 12th is from February 8 to March 7. After analyzing several biological years, you will find that each of the above-defined “bio-months” has its own characteristic face and its emotional coloring is repeated from year to year. The content of events, naturally, will be different every year, but your impression of each “bio-month” will remain strikingly similar. Everything depends on the annual rhythm of our life.

A generalized annual viability curve is presented in Pic.4.

![Biological Year Curve](Image)

We have to pay attention to the failures of the second and twelfth “bio-months”. These are critical periods. Biorhythms are most unbalanced during these periods of any bio-year. At these periods, the body benefits from reducing physical and mental stress. Of course, each person is unique, so deviations in the individual curve in both directions are possible, but as statistics dictate, no more than 15 days error.

In the 19th century, when most people died, as they say, “in their own time,” the peaks of deaths occurred in the 2nd and 12th biological months. Now, due to the advances in medicine, the situation is somewhat unclear, but even today the peak of heart attacks, for example, occurs in the 2nd biological month. During these periods, the body is weakest, susceptible to infections, nervous breakdowns, and during these months it needs help. Do not overload your 2nd and 12th biological
months with unnecessary physical and mental work, then the body itself will cope with the difficult period of its life.

There is a “slide” before every “failure” period of your bio-year. On it, the body seems to pick up speed in order to, by inertia, slip through the “pits” of the 2nd and 12th bio-months. In fact, statistics shows that the safest month for heart patients is the first month after the person’s birthday. This means that it is important to take advantage of your “good” periods, and these are the 1st, 9th, 10th bio-months. The intermediate hills and pits of the annual biorhythm are not so noticeable. Usually the wheel of our life passes them easily, and only when the axis of health begins to creak do, they immediately make themselves felt.

Let’s imagine for a moment that for some reason. For example, illness, you cut off the tubercle of the first biological month. Then you will slide into the energy hole of the second month at a very low speed and you will have to climb out of this hole. The same applies to the 9th and 10th months - before the pit of the 12th.

Superimposed on the biological year is the astronomical year, starting from the moment of the vernal equinox. It makes seasonal adjustments to the curve related to the rhythm of daylight hours and air temperature fluctuations (See Pic. 5) [13].

In spring, people’s immunity decreases, mental crises develop, and physical activity intensifies (children grow faster). At the same time, the ability to learn, attentiveness, and thoroughness deteriorate. Sexual activity often increases, sometimes leading to recklessness. Those whose critical month of the bio-year falls in spring experience these influences with increased sensitivity. In autumn, a person becomes more balanced, gravitates toward improving own life, and he(she) is more inclined to spiritual rather than physical work.

The astronomical year also has two critical months for everybody - February (spring-summer restructuring) and August (transition to the autumn-winter season). It is not difficult to understand that people whose second or twelfth biological months fall in February and August should be especially attentive to their body at these times.

Pay special attention to the author’s interpretation of these rhythms calculated with the personal software (See Pic.6) [2].
Thesis 4: The influence and application of reflexology rhythms. Ancient Chinese biorhythms are an interesting and unique system that can be used to improve SMS of shipping companies. This system of rhythms, based on thousand years of experience accumulated knowledges. Their concept is based on the assumption that a human organism has internal rhythms of general psychological and biological states.

The next text will explain little bit the base of the theory of Ancient Chinese rhythms (See Tab.1).

Table 1

<table>
<thead>
<tr>
<th>English</th>
<th>Deutsch</th>
<th>Latin</th>
<th>Français</th>
<th>Numerical Index</th>
<th>Common Channels’ Names</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lu</td>
<td>Lu</td>
<td>P</td>
<td>P</td>
<td>I</td>
<td>- Lungs Meridian</td>
</tr>
<tr>
<td>LI</td>
<td>Dj</td>
<td>IC</td>
<td>GI</td>
<td>II</td>
<td>- Large Intestine Meridian</td>
</tr>
<tr>
<td>SI</td>
<td>M</td>
<td>V</td>
<td>E</td>
<td>III</td>
<td>- Stomach Meridian</td>
</tr>
<tr>
<td>SP</td>
<td>MP</td>
<td>LP</td>
<td>RP</td>
<td>IV</td>
<td>- Spleen and Pancreas Meridian</td>
</tr>
<tr>
<td>HI</td>
<td>H</td>
<td>C</td>
<td>C</td>
<td>V</td>
<td>- Cardiac Meridian</td>
</tr>
<tr>
<td>SI</td>
<td>Du</td>
<td>IT</td>
<td>IG</td>
<td>VI</td>
<td>- Small Intestine Meridian</td>
</tr>
<tr>
<td>BI</td>
<td>B</td>
<td>Vu</td>
<td>V</td>
<td>VII</td>
<td>- Bladder Meridian</td>
</tr>
<tr>
<td>K</td>
<td>N</td>
<td>R</td>
<td>R</td>
<td>VIII</td>
<td>- Kidneys Meridian</td>
</tr>
<tr>
<td>HC</td>
<td>KS</td>
<td>PC</td>
<td>MC</td>
<td>IX</td>
<td>- Pericardium Meridian</td>
</tr>
<tr>
<td>HT</td>
<td>3E</td>
<td>SI</td>
<td>TR</td>
<td>X</td>
<td>- Triple Heater Meridian</td>
</tr>
<tr>
<td>GB</td>
<td>G</td>
<td>VF</td>
<td>VB</td>
<td>XI</td>
<td>- Gall Bladder Meridian</td>
</tr>
<tr>
<td>Liv</td>
<td>Le</td>
<td>H</td>
<td>F</td>
<td>XII</td>
<td>- Liver Meridian</td>
</tr>
</tbody>
</table>
Modern reflex therapy concept provides selection of both location (points) and manner of intervention and optimum time of therapeutic manipulations (moment of actions). Efficient therapy is only possible with individual approach to each patient. It requires detailed study of initial organism state, which means patient condition within certain time interval, especially in the period of treatment. It may be achieved by means of strict recording of personal features of the patient, disease development dynamics, prevailing of a particular syndrome and data obtained from other sources of diagnosing. The entire complex of treatment, including reflex therapy is composed referring to this data. Meridians activeness and idleness time theory developed by ancient Oriental scientists is important to understand cyclic nature of multiple diseases progress. Knowledge and awareness of features of annual, seasonal, monthly and daily biorhythms is important not only to treat successfully already existing diseases but also to prevent their generation and development.

Nowadays, science interprets it as circadian, daily and close to daily rhythms. Actual values of meridian hourly activeness within a day meet the modern data of organs and systems functional activeness. Summarized data on activities of urgent medical service in Kiev city and Kiev Region showed the following pattern [13]:

- The highest number of calls on occasions of bronchial asthma attacks is noted within morning hours (03:30 am – 06:00 am).
- The highest number of calls on occasions of kidney pathologies is noted within evening hours (05:00 – 08:00 pm).
- The highest number of calls on occasions of liver and gall bladder (11:00 pm - 03:00 am).

This data actually meets maximum activeness time of lungs, kidneys, gall bladder and liver meridians. Obviously, all the organs and systems of human organism are not required to function with same intensity throughout a day. Evolving nature developed activity or idleness of either system or organ within the most appropriate periods favorable for an organism. From this point of view activeness of the Large Intestine Canal from 05 am till 07 am is quite understandable. Intestines should be emptied prior intense motion in the course of hunting, whether it is a human or wild beast. At the further stage Stomach Channel gains activeness (07 – 09 am) being the time of eating which had been also fixed evolutionally. At the further stage after eating Spleen and Pancreas channels set to work, etc. This explanation is applicable to maximum activeness of other meridians for certain time intervals within a day.

The modern physicians displayed great increase of their interest in human organs’ specifics of daily activities. It is caused with demand for exploring of physical stamina and working capacity. Data on rhythmical functionality of human organism are of great value for practical medicine, since they enable to reject “cookbook” approach to prescribing medicines. There are also other factors speaking in favor of periodical rises and drops in organs and systems activeness. Knowledge of such factors enables to choose optimum time of prescribing for an individual medicine, or, speaking about reflex therapy, a time of session. Thus means, when reflex therapy is applied with extended effect of micro-needles, magnetic appliances, tsubo massage may be introduced to prevent recrudescence prior the expected moment of attack [13].
Ancient Oriental healers supposed that reflex therapy application prior attack of disease means to step to meet spoiled energy, i.e. to prevent attack by means of dissipation of noxious energy. Classical acupuncture provides that the best sedative effect in meridian may be reached during its activeness and maximum stimulating effect may be obtained during idle period, i.e. within forthcoming two hours after activeness period or within idle period.

Table displays data on actions applied to sedative and stimulating points according to rhythmical hourly correlation (See Table 2) [13].

**Table 2. Action of sedative, stimulating and assisting points according to their rhythmical correlation by I. Manaka and I. Urquhart, (1979; as amended)**

<table>
<thead>
<tr>
<th>Meridians:</th>
<th>Tide Interval</th>
<th>Ebb Interval</th>
<th>Passive (Idle) Period</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Time</td>
<td>Sedative point</td>
<td>Time</td>
</tr>
<tr>
<td>- Lungs meridian</td>
<td>3—5</td>
<td>P (I) 5</td>
<td>5—7</td>
</tr>
<tr>
<td>- Large Intestine meridian</td>
<td>5—7</td>
<td>GI (II) 2</td>
<td>7—9</td>
</tr>
<tr>
<td>- Stomach meridian</td>
<td>7—9</td>
<td>E (III) 45</td>
<td>9—11</td>
</tr>
<tr>
<td>- Spleen and Pancreas meridian</td>
<td>9—11</td>
<td>RP (IV) 5</td>
<td>11—13</td>
</tr>
<tr>
<td>- Cardiac meridian</td>
<td>11—13</td>
<td>C (V) 7</td>
<td>13—15</td>
</tr>
<tr>
<td>- Small Bowel meridian</td>
<td>13—15</td>
<td>IG (VI) 8</td>
<td>15—17</td>
</tr>
<tr>
<td>- Bladder meridian</td>
<td>15—17</td>
<td>V (VII) 65</td>
<td>17—19</td>
</tr>
<tr>
<td>- Kidneys meridian</td>
<td>17—19</td>
<td>R (VIII) 1</td>
<td>19—21</td>
</tr>
<tr>
<td>- Pericardium meridian</td>
<td>19—21</td>
<td>MC (IX) 7</td>
<td>21—23</td>
</tr>
<tr>
<td>- Triple Heater Meridian</td>
<td>21—23</td>
<td>TR (X) 10</td>
<td>23—1</td>
</tr>
<tr>
<td>- Gall Bladder meridian</td>
<td>23—1</td>
<td>VB (XI) 38</td>
<td>1—3</td>
</tr>
<tr>
<td>- Liver meridian</td>
<td>1—3</td>
<td>P (XII) 2</td>
<td>3—5</td>
</tr>
</tbody>
</table>

Data about these rhythms allow to select optimum time of treatment sessions. In some cases, disease attack may be prevented, in other cases optimum time to strengthen functioning of an individual organ or system may be found. Consequently, such cases require an individual approach. As it is known, maximum indications or aggravation of any disease depends on compensability of appropriate system. Thus, diseases running with signs of hyperfunction will display acutely in maximum daily activeness periods of appropriate systems. On the contrary, diseases running with signs of hypofunction are expressed most brightly in system minimum activeness periods. The use of daily activeness periods for human organs and systems enables not only to identify a disease but also to choose an optimum time for both medical treatment and reflex therapy.

There are more than 100 physiological processes exposed to daily rhythmical oscillations. Biological rhythms are not restricted to daily oscillations. There are monthly (moon), seasonal, solar activeness related and other alterations in biological rhythms.

Nowadays, in a number of states worldwide, the thorough attention attracts meteoprophylactics scheme. Traditional oriental medicine also admits influence of
meteorological factors on human organism. Meteopathycal reactions may be prevented, firstly by means of maintaining general energy balance Yin/Yang and energy balance within individual channels by means of applying actions to appropriate points. Principles of Energy Regulations for 12 main meridians have been developed on this purpose.

Traditional oriental medicine basing on principles of unity and deep harmony of mutual relations of a human being with surrounding nature, connects condition evaluation and treatment tactics with cosmic influence and natural factors. Such cosmic processes as solar outbursts and accompanying magnetic storms, atmospheric front’s motion and changes in weather correlate with frequency of catarrhal diseases, hypertension crisis, and heart attacks as well as psychical diseases exacerbation. It is supposed, that solar activeness and associated geomagnetic disturbances cause misbalance in internal rhythms of human organism with rhythms of environment. So, these rhythms are associated with various aspects of life: including health, energy, mood and work productivity. According to the model of ancient eastern philosophy, the harmony of the biorhythms leads to well-being and success. Ideally, it looks like in Pic. 7 [2].

The actual rhythm modeling must be interpreted using the ancient Chinese “Treble Clef Tao”. Its 3-D model is complex for modern use as the mathematics of a twisted “Möbius strip” may explain the real described process only. Therefore, the simplified “Pascal's Snail” formula was used for calculations. These are cardioids, arranged with a phase shift in the flow of energy along the 12 meridians of the reflexology model of the body’s activity. It is the simplified basic mathematical formula for describing rotating cosmic bodies around Sun. Only you need to perceive this picture in 3D space, and not in the plane of drawn cardioid circles (See Pic.8) [2].
Reflexology refers to a treatment method based on the activation of certain points on the body that are physiologically connected to various organs and systems of human body. It includes massage, the use of various stimulation techniques (toning-activation or sedation-inhibition) of reflexogenic zones. This approach is based on the idea of the interactions between various organs and systems of a human organism, as well as their confluence on the overall well-being and health of a person. The following pictures 8 and 9 interpret the daily good periods of favorable activity of different reflexology channels over a 24-hour period [2].
The use of reflexology biorhythms has several advantages in SMS of any shipping company:

- **The firstly**: Their study can be included in crew training programs to reduce stress and increase overall comfort and psychological well-being.
- **The Secondly**: The regular sessions of reflexive self-massage will help crew members cope with physical and emotional stress, which in turn will improve their concentration and stress tolerance.
- **The Thirdly**: Both, the mentioned above, benefits will be useful for ensuring the safety of passengers. Regular sessions of preventative acupressure or area massage can help passengers cope with emotional stress, improve their overall well-being and reduce the risk of health problems during travel. This is especially comfortable for passengers who experience fear or anxiety while sailing.

Since a SMS of shipping companies plays a leading role in maritime and inland water transport, deviations from its regulatory requirements often lead to emergencies (accidents, serious accidents, and even loss of human life). The recording and analyzing biorhythm data of personnel could help improve the SMS in terms of recommendations for making timely decisions to prevent possible problems due to the erroneous actions by own workers. It will allow to minimize such situations. There are several uses for this information:

1. The first of them is determining the optimal periods of crew work. Different rhythms have their own peaks and valleys of activity. For example, biorhythms such as physical, emotional and intellectual have long been taken into account in the field of psychiatric medicine. Using this knowledge, it is possible to determine the optimal periods when the crew will be most effective and focused to solve complex problems. This approach will reduce the likelihood of errors and the accumulation of fatigue. It would help to increase the level of professional skills also and the efficiency of their use. All mentioned above will be useful for keeping a high level of safety in maritime and inland water transport.

2. Another way to use the system of ancient Chinese biorhythms is to predict the human condition at any moment of work. By knowing which biorhythms affect energy, concentration and emotional state, it is possible to predict when staff may be in poor health and most susceptible to making erroneous actions. It will allow to make appropriate early action, such as taking a break or offering additional support, to prevent potential problems and to minimize the risk of theirs occurring.

3. This system of biorhythms can also be used to improve teamwork of the crew. Different people have the same cycles of these biorhythms, but the level of their activity is different for everyone. Understanding this principle and assessing the differences in the activity of these rhythms will help in forming effective teams and distributing tasks in accordance with the needs and capabilities of each crew member. For example, this will minimize psycho-emotional incompatibility and the likelihood of conflicts among the personnel, which will ultimately contribute to the effectiveness of the SMS of any shipping company.

Conclusion. The use of lunar and other human biorhythms to improve the SMS in maritime and inland water transport will be convenient and innovative approach to the safe and efficient operations of shipping companies. Analysis and recording the biorhythms and their activity of own personnel at different periods of time will
make possibility to more accurately determine the optimal periods for performing production tasks. It would minimize the risk of making erroneous decisions, reduce the likelihood of accidents and emergencies, increase the productive performance of personnel also.

Forecasting the psychophysiological state of the workforce, determining the optimal periods of its work, rest and training, improving the compatibility of crews - all these factors can increase the efficiency of transportation by sea and inland water transport.

It is necessary to conduct further research into the benefits of automated application of the patterns of the above-described rhythms, to develop appropriate methods and software that will allow realizing the scientifically based potential of the biorhythms use in the SMS of the Ukrainian shipping companies.

References: