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SUMMARY

In the present work we are called to refer to the electronic instruments used by the ship to safely transport cargo and passengers to their destination having the means and knowledge to achieve it, so as not to be affected by any changes due to weather conditions. The work is divided into chapters, each of which refers separately to each instrument.

In the first chapter we talk about the gyro compass, indicating its use and giving a definition of what it is. In the second chapter we refer to the S-band and X-band radar and its characteristics, its mode of operation, in technical characteristics, but also the uses of the marine radar. The magnetic compass follows in the third chapter and reports are made on its use and operation, while we also compare it with GPS.In the fourth chapter we talk about the automatic rudder and how to apply it, while in the fifth chapter we analyze the ARPA system. In the sixth chapter we talk about the automatic monitoring system and in the seventh we refer to the historical data and the use of the speed and distance recorder. In the eighth chapter we refer to the sound recording equipment or dipper, in particular its operation, its use, and the risks that lurk from it. The ninth chapter includes the electronic display information system. The tenth chapter refers to the automatic reading system and its use. In the eleventh chapter we analyse the system of long-distance monitoring and recognition, while in the twelfth chapter we refer to the rudder angle index. The thirteenth chapter follows the voyage data recorder, based on its function and characteristics. In the fourteenth chapter we are talking about the rate of turn and how it works, while in the fifteenth we refer to the GPS receiver. In the sixteenth chapter, reference is made to the sound

system, while in the seventeenth chapter we refer to navigation lights. The nineteenth chapter includes the daytime running lamp and the twenty-second router. Finally, in the twenty-first chapter we refer to the transmission device and the flags of the ship.

INTRODUCTION

Modern seafarers are trained to know how all modern navigation equipment, which has made sailing at sea more smoothly and safer.

Thanks to modern facilities and automation, ships today have many advanced navigation equipment systems that provide accurate data on the journey. At this work we will try to present 22 different types of navigation equipment available on all commercial ships today.

CHAPTER 1

Gyrocompass

A) In general

Gyro compass is a type of gyroscope that is widely used on ships using a power-driven, fast, rotating gyroscope and friction forces, among other factors that use the basic physical laws, gravity influences and the orbit of the Earth to find the real north.

The gyroscope is designed for high-precision marine applications, such as offshore activities and seabed mapping.

B) Use

It's used to find the ship in the right direction. Unlike a magnetic compass, a gyro compass is not obstructed by an external magnetic field. It is used to determine the correct northern position, which is also the axis of rotation of the Earth to provide a stable guiding source. Its repeater system shall be installed on the steering platform for the use of emergency steering wheel.

CHAPTER 2

Radar

A) S-band and X-band radar

Marine craft shall be based on a S-band and X-band navigation system as this can detect targets and display the information on the screen, such as the distance of the ship from the ground, any floating objects (islands, rocks, icebergs and other), other vessels and obstacles to avoid collision. It's a rotating antenna that detects the surrounding area of the ship.

With the aid of the ship's radar, accidents can be avoided at sea by using the various inherent radar functions (determination of CPA and TCPA, EBL, VRM, etc.).

However, even when the ships are anchored in the port, with the help of these radars, the coast guard, the VTS and the other authorities can use them to monitor traffic on the low range of radar.

B) Features

The ship's radar has a monitor (referred to as a project position indicator) showing all the objectives within the radar range. As all objects are visible on the screen, navigation and monitoring of the position of the ship are actually made possible, hence the term "navigation aid."

The main characteristics of marine radars can be explained as follows:

- The parabolic radar antenna is transmitting and receiving electromagnetic waves. With regard to one objective which appears, this is basically the wave bouncing from a particular object stained in PPI (Project position indicator).
- The frequency and time required for the return (revocations) to the ship's radar receiver helps to discover whether the vessel's path may continue or not.
- The transmission and reception of the pulse travels twice the distance and hit the target and back. Therefore, the target set out in PPI is basically half in relation to its scope.
- In PPI, reflections may be shown in such a way that the localisation of the real distance of the objects is even easier. The same colour in PPI may also be checked for the determination of the target bearing.

C) Operation

Marine radar is operating at the basic principle of electromagnetic waves. The radar antenna shall send the high-speed electromagnetic waves to determine the location, which is the distance, the speed and direction that the wave travelled along with the height of the object, moving or stationary.

The electromagnetic energy travels through the air at a high steady speed, equivalent to the speed of light (300,000 kilometers per second).

The radar system emits electromagnetic waves as a high-speed signal that travels several miles into the direction of the radar. If there are no objects in the direction of the wave, the radar screen shall appear blank.

If there is an object reflecting the wave back on the radar, the radar computer shall determine the distance between the ship and the object together with its position. Therefore, it can be said that the radar reads basically two things: The location of the object and the direction of the same.

Position of object:

The radar antenna is constantly rotating over the ship sending and receiving signals. As a result, the radar scans the signals all over the ship. As radar pulse waves are reflected by an object, they shall travel in the same direction and be taken from the radar by detecting the position of the object. When the pulse is taken again, the computer monitor will record the position.

Distance from the ship:

As the radar antenna sends and continuously receives signals from the object during the electromagnetic signal, the signal received is sent back to the computer unit, which calculates the time required to reflect the radar signal. Once the computer knows the time, it will calculate the distance using the speed and time type.

D) Marine radar uses

- It is used to calculate the range of a target and then the information is used to determine the speed, the course, etc.
- Integration with other ship equipment (such as ECDIS) to obtain accurate data
- Navigate his own boat and its course to avoid a collision

- Correcting the position of the ship using ground objects such as lighthouses, buoys, etc.
- Differentiation between targets in high traffic density areas
- Determination of the weather, to some extent
- Use by VTS for coastal traffic control
- Use features such as parallel indexing to ensure safe navigation
- Reduce the workload to OOW on the bridge
- It is widely used in navigation that covers the above aspects

E) Technical characteristics

The most important point about marine radar is that the screens used to view the position of objects are either LED screens or monochrome screens.

With such perfect displays, the clarity of the objects is highlighted even more. Also, as these screens are waterproof, there is no risk of disruption to the ship's radar system in weather conditions.

The vessel monitoring system has been further developed to include even vessels. This means that even boat owners can be sure of their ship's safety while in the water.

An important advantage of marine radar is that energy and electricity consumption from them is much smaller. This means that marine radar is not only user-friendly but also helps the owner to regulate the cost of power and electricity.

Radar was an important tool for the assistance of marine navigation over the past six decades. Over the years, radar technology has been developed to include not only aircraft but also ships.

Sea travel and security have become so attainable. We can hope that more such monitoring devices will be developed in the future in order to avoid many marine casualties and accidents.

CHAPTER 3

Magnetic compass

A) In general

The magnetic compass contains a magnetic element that is in line with the earth's magnetic field. It has two magnetic poles, northbound and south, and close to the geographical North and South Pole. When a magnetic element (such as mineral limestone or ferrous metal that has magnesia) is allowed to float freely, it will substantially indicate north and south, showing how they go in relation to this axis.

The northern and southern poles of the earth are close, but they are not completely aligned with the magnetic poles. The difference between them is expressed as an angle called deviation (on nautical charts, this is called a variation).

The geography poles, known as "True North" and "True South," are in line with the earth's rotation axis, the imaginary line running around the earth around which it revolves. To make things even more complex,

the earth's magnetic field changes a little each year, making it impossible to permanently mark its poles in bullets and maps. Cartographers face this problem by printing a "Compass Rose" on charts and maps showing the difference between real and magnetic north and notes the change in deviation every year.

B) Magnetic compass and GPS

The magnetic compass has travelled a long way since the sailing days of Zheng Hee, and some people probably argue that we don't need it now that we have satellites in space sending signals to GPS units. GPS is a great progress in navigation technology, but only one cannot expect the signals will always arrive at the GPS unit and the electronic instruments will always work perfectly. A magnetic compass is simple and relatively cheap, never needs batteries, and it's much more user-friendly.

C) Operation and use

The magnetic compass functions in conjunction with the earth's magnetic field and is the main instrument of the direction indicator. It shall be used to obtain the planned journey path. The navigation equipment of this ship is normally located in the central line of the ship. The magnetic type shall be positioned so that the output signal can be displayed on the navigating bridge.

CHAPTER 4

Automatic rudder

A) In general

The automatic steering wheel is based on the use of an automatic steering control system on board. The use of the automatic steering wheel can reduce fuel consumption by flexing the rudder movements that are used to keep a steady course. Efficient and adaptive steering operations shall allow minor deviations in the service line but shall use lower and lower steering gear to maintain the service line. This reduces the steering of the rudder and therefore reduces fuel consumption.

B) Application

The adjustment and use of the automatic rudder applies to all types and ages of boats.

The optimisation of the autopilot shall be quick to apply, assuming that the automatic steering wheel is already installed on all vessels. However, some effort will be needed to check whether proper arrangements have been applied by the crew and the complexity of the system is low due to the adaptive self-learning systems on board.

For optimum regulation and use of the automatic steering wheel, best practice shall be applied to the ship's procedures (including the recommendation for the optimum number of rudder and corner movements for different conditions at sea). The crew must be adequately trained to achieve savings potential.

The navigating bridge is full of equipment and instruments used for navigation. The automatic steering wheel is considered to be one of the most effective navigation aids on the navigating bridge as it helps the human operator to steer the vessel by holding the steering wheel in an automatic steering wheel, enabling them to focus on the broad aspects of operation. It is a combination of hydraulic, mechanical and electrical systems and is used to control the ship's steering system from a remote location (navigating bridge).

CHAPTER 5

ARPA

A) In general

An automatic radar design aid shall display the position of the ship and other vessels of vessels. The radar displays the position of the ships in ships and selects a course for the ship, avoiding any kind of collision.

This navigation equipment on the navigating bridge continuously monitors the ship's environment and in this case automatically determines the number of targets; ships, vessels, fixed or floating objects etc., and their speed and course shall be designed accordingly.

It also presents them as vectors on the screen and continuously updates the parameters with each antenna rotation, counting the closest proximity points on their own ship, as well as time before that happens.

B) Operation

Basically, ARPA is the equipment of a computer system operating in combination with radar. The radar transmitter produces very small pulses in radio waves. When the waves of one of these pulses meet any obstacle, such as part of a ship or shore, a percentage of radiated energy shall be reflected and taken from the original radar. The reflecting pulse is an echo. The time between pulse and echo radiation can be measured with precision. Therefore, the distance between the radar and the ship is calculated. The direction of the ship is the direction of the pulse transmitted. All radar installations shall comply with the IMO. The variable area indicator shall be capable of measuring the range of an item not exceeding 1,5% of the maximum scale of the scale used, or 70 metres, whichever is greater.

CHAPTER 6

Automatic monitoring system

A) In general

As with ARPA, the automatic monitoring system shows information on the objectives monitored in graphic and numerical form to create a planned plan for a safer path without conflict.

Usually, a large target with a region of 800 metres or more is not monitored. Pensioners less than 800 metres shall be considered to be targets to be monitored.

CHAPTER 7

Speed and distance recorder

A) Historical data

The first real practical calendar was the log chip, a flat square piece of wood. A lead on the circular side of the track, or chip, made it float in an upright position and resist the tug. He flew into the sea attached to a line of nodes on known distances. The number of knots measured was associated with a reading from a special hourglass and gave the ship's speed. The term node, which means a nautical mile an hour, comes from the nodes on the log line.

A subsequent version was the patent registration file (towed log) which replaced the chip with a rotating rotor. The movement of the ships in the water turned the propeller and its perversions were transferred to a mechanical device called the "log register" and recorded, revealing the distance covered at any time. The "Captain" was used to maintain the rotation of the recording line in a uniform and free manner. Sometimes the registrar turned electrically a repeater usually placed on the bridge.

This bridge equipment on a ship shall be used to measure the speed and distance travelled by the ship from a given point. In the same calculation, the ETA of the ship shall be adapted or transmitted to port authority.

CHAPTER 8

Echo Sounder

A) Operation

There are many modern navigation ships and the sink is an instrument used for almost 100 years. It is used to measure the depth of water under the bottom of a ship using sound waves, operating on the sound waves of sound waves and a sound pulse bouncing from a reflecting layer and returning as an echo at the source.

B) Risks

One of the dangers facing a ship is that of running. Usually, a vessel determines its position by GPS, radar, Decca, Loran or optical ruhman. The depth of the water is controlled by the water meter as a routine matter to determine that the depth obtained matches what appears in the graph. However, when the position is not known accurately while the ship is approaching the port, or crosses an area, or located near the estuary of a river, or in a region with a minimum survey, the distance below the carina and the depth of the water shall be known.

C) Use

The sink is a type of SONAR device (Sound Navigation And Ranging) used to determine the depth of water by transmitting sound pulses to water.

It operates with the principle of sound waves from the bottom of the ship and then measuring the time required for the return of the echo from the sea. If the speed of sound in water is known, time will be proportional to the distance travelled.

For the use of the principle of scope it is necessary to send the energy signal and measure the length of time to reach the reflection. In the case of echoes, the signal may not be electromagnetic, as there is a strong weakening in water. It cannot be light because water is not transparent and there is no mirror that reflects the surface on the seabed. The dissemination of sound is done by regulating vibrations in the medium. The water is almost uncompressed, so if vibrations of a very small size are created, they can travel long distances.

CHAPTER 9

Electronic Chart Display Information System (ECDIS)

A) In general

ECDIS is a development of a navigation map system that is used on ships. Thanks to the use of electronic navigation equipment, it became easier for the ship's crew to determine the location and became easier to navigate than before.

B) Use and operation

ECDIS complies with the Rules of Procedure IMO V / 19 & V / 27 of the SOLAS Convention as amended, displaying selected information from an Electronic System Navigation Chart (SENC). The ECDIS equipment complying with the SOLAS requirements may be used as an alternative to maps. In addition to enhancing navigation safety, ECDIS significantly facilitates the workload of the pilot with its automatic capabilities, such as route planning, route tracking, automatic ETA calculation and ENC information. In addition, ECDIS provides many other sophisticated navigation and security capabilities, such as a continuous recording of data for future analysis.

The ECDIS uses the Global Positioning System (GPS) feature to successfully locate the navigation points. It should also be noted that the ECDIS complies with the requirements laid down by the International Maritime Organisation, thereby increasing the reliability of the electronic chart system. ECDIS is basically a navigation information system, interconnected with other navigation equipment such as GPS, gyroscope, RADAR, ARPA, Echo Sounder and others.

The ECDIS shall also incorporate information contained in other maritime issues, such as Tide Tables and cruising instructions and integrate additional maritime information such as radar information, weather conditions, ice conditions and automatic identification of vessels.

Advantages of ECDIS in relation to maps:

- All information shall be processed and displayed in real time
- Facilitates the procedure for the design of crossings
- Someone can get all the necessary navigational information at a glance
- Alarms and indications are available to indicate and indicate the risks
- Graph correction is easier in ECDIS compared to paper charts
- The diagrams can be adjusted according to the travel requirement
- Other navigation equipment such as AIS, ARPA etc., can be invoked and incorporated
- The diagrams can be oriented according to the requirements
- With the ability to zoom in and out, features can be customized as needed
- Someone can get a more accurate ETA
- Graphs can be asked for detailed information
- Overall, it improves navigation safety

CHAPTER 10

Automatic Identification System (AIS)

A) Use

AIS is also among the types of navigation systems that help accurately determine the location and other navigational statistics of ships. AIS uses VHF radio channels as transmitters and receivers for sending and receiving messages between ships, allowing a variety of tasks.

In accordance with the International Maritime Organisation (IMO) rules, all passenger and commercial ships above 299 gross tonnage engaged in international transport shall be equipped with a Class A transponder.

AIS (Automatic Identification System) is a system that transmits the position of a ship so that other ships are aware of its position in order to avoid conflict. The International Maritime Organisation (IMO) requires the use of AIS on vessels greater than 300 tonnes travelling internationally. Many national governments have authorised vessels that do not fall under the IMO Regulation to use AIS. Each year, more than 300,000 unique AIS devices transmit the location of a vessel along with other information, including identity, course and speed. Earth stations and satellites collect this information, which means that the movements of a ship can be monitored even in the remotest parts of the ocean. Although the use of AIS is not universally applicable to fishing vessels, it is estimated that AIS vessels account for more than half of the fishing effort for more than 100 nautical miles from the coast and up to 80% of the fishing on the high seas 1.

CHAPTER 11

Long-range identification and tracking (LRIT)

A) In general

The Long Range Tracking and Identification (LRIT) is an international identification and identification system integrated by the IMO under the SOLAS Convention to ensure an integrated monitoring system for ships around the world.

It was created on 19 May 2006 and has been formally incorporated since January 2008. On the basis of these lines, ships constructed on 31 December 2008 or had to have this vessel identification system.

LRIT is an international identification and identification system integrated by the IMO in accordance with the SOLAS Convention in order to provide an integrated monitoring system for ships with a total capacity of 300 or more for international travel throughout the world. This marine equipment is designed to sensitise marine field.

CHAPTER 12

Steering wheel angle indicator

A) In general

The steering angle indication, as indicated by the name, indicates the steering angle. The monitor is located in the navigating bridge console, so the ship's navigator can control the driving speed and steering angle. The indication shall also be provided on the edge of the navigating bridge and in the engine control chamber.

CHAPTER 13

Voyage data recorder (VDR)

A) In general

Voyage data recorder, or VDR, is a data recording system designed for all vessels required to comply with the IMO International SOLAS Conventions to collect data from various sensors on board. It then digitizes, compresses and stores this information into an external protective storage unit. The protective storage unit shall be a waterproof unit designed to withstand extreme conditions, impact, pressure and heat, which may be related to a marine incident (fire, explosion, collision, draught, etc.).

Ships with a total capacity of 3,000 or more constructed on or after 1 July 2002 must carry a voyage data recorder (VDR) to assist in accident investigations, in accordance with regulations adopted in 2000, which entered into force on 1 July 2002.

B) Function and features

The protective storage unit may be located in a recoverable fixed unit or free-slip unit (or in combination with EPIRB) when the ship is submerged in a marine casualty. The last 12 hours (48 hours for the 2014 MSC.333 regulations) of stored data in the protected unit can be retrieved and replicated by the authorities or ship owners for occurrence research.

In addition to the protective storage unit, the VDR system may consist of a recording control unit and a data acquisition unit linked to various equipment and sensors on board. The new MSC.333 regulations shall also set out at least 30 days of recorded data to be kept internally (this could be within the recording control unit, the data acquisition unit, the main e-unit according to the terms of the manufacturers).

C) Use

Although the primary purpose of the VDR is to investigate accidents after the event, there may also be other uses of recorded data for preventive maintenance, performance monitoring, weather gravity analysis, accident prevention and training purposes to improve safety and reduce operating costs.

D) Application

The simplified voyage data recorder (S-VDR), as defined by IMO Performance Standard MSC.163, is a simpler version of lower-cost VDR for small ships with only recorded master ship data.

The VDR is a key tool in the navigation equipment list installed on board to record continuously important information related to the operation of the ship. It contains a voice recorder system for at least the last 12 hours. This entry is re-established and used for facts investigation. The importance of VDR is like a black box placed on a plane 1.

CHAPTER 14

Rate of turn

A) In general

The rate-of-turn indicator or roti on ships shows the pace of a ship. Indicates the rate that a ship is turning in degrees per minute (° / min). It's one of the most important organs an assistant can have when it leads to a course. It can also be used for rotation with a constant rate of turn, which is very important for navigation water.

B) Operation

The beginning of the rate of the rate-of-turn indicator is based on a gyroscope with a turning point in one direction only. When the ship leads to a straight course, the gyroscope will indicate in a straight direction and the indicator will show zero on the screen. When the vessel turns to the door, the gyroscope will return to the port side due to inactivity and this will be noted on the screen of the rate of turn indicator. The same can be said on the right side.

There are two types of rate-of-turn indicators: A digital type and an analogue type. Today the analogue formula is still the most installed type on ships, because of the easy way of reading the rate of turn quickly and correctly. The analogue type is mandatory, the digital format may be installed in the form of an analogue type repeater.

This navigation tool shows how fast the ship is turned at steady speed (useful during navigation and manoeuvres), which usually occurs as a number of turning points. The rate of turn of the ship shall be measured in degrees per minute. This important tool helps the steering wheel steer the course safely.

CHAPTER 15

GPS receiver

A) In general

A Global Positioning System (GPS) receiver is an imaging system used to depict the position of a ship using a global positioning satellite in an Earth orbit.

Recording the position of the ship, the speed, course and time required to cover the distance between the "two marked positions" can be calculated.

CHAPTER 16

Audio reception system

A) In general

This speaker system is necessary for a ship with a fully closed bridge. This allows the navigator in the cabin to hear audio signals from other ships in the area. It is installed on the console of the ship's equipment on the navigating bridge and helps the pilot to perform the clock according to International Standards for the Prevention of Conflicts in the Sea.

CHAPTER 17

Navigation lights

A) Historical data

All vessels - large or small - must have night lights as part of their navigation systems. This system was introduced in 1838 by the United States, followed by the United Kingdom in 1849. In 1889, the United States established the International Maritime Conference to lay down appropriate guidelines for the prevention of marine casualties. In 1897, these rules were formally adopted internationally. Navigation lights are one of the most important navigation equipment required for sailing on the high seas, allowing a clear view of its own ship in relation to other nearby ships.

B) Operation

A navigation light, also known as operating or position light, shall be a source of illumination on a vessel, aircraft or spacecraft. Navigation lights shall provide information on the location, header and condition of a vessel. They are imposed by international conventions or political authorities. Navigation lights are not intended to provide illumination for the vessel that makes the pass, only for other vessels that know it.

A navigation light, also known as operating or position light, shall be a source of illumination on a vessel, aircraft or spacecraft. Navigation lights shall provide information on the location, header and condition of a vessel. They are imposed by international conventions or political authorities. Navigation lights are not intended to provide illumination for the vessel that makes the pass, only for other vessels that know it.

Small craft powered by an engine (less than 12 m) can carry a single full white light in the position of two or three white lights carried by larger vessels, and must also carry red and green navigation lights. Vessels of less than 7 metres (23 ft) with a maximum speed of less than 7 knots shall not be required for the carriage of navigation lights but shall be capable of indicating white light. Vessels operating in congested areas may also bear a yellow flashing beacon for additional visibility during the day or night.

CHAPTER 19

Daytime running lamp

A) In general

These are light-signalling devices used for alarms during the day (and may also be used at night). Like other emergency equipment at sea, the power source for the lamp is not entirely dependent on the main power source of the ship. In addition, the lamp housing shall be made of weather resistant and seawater resistant material.

CHAPTER 20

Router

A) In general

The router operates on the basis of geographical areas and weather conditions. It puts the best route not only on the basis of the shortest route, but also uses data on storm, geography, currents, waves and other weather conditions for calculating the safer and cheaper route for the ship to the port of destination.

CHAPTER 21

A) Transmission device (THD)

THD is an electronic device used to display information about the actual direction of a ship.

B) Ship flags

Different types of flags are used with different colors and signs to show the location of a navigational ship. Signaling flags - are well-known, used since ancient times and continue to be used on all ships today.

CHAPTER 22

Sextant

A) Use

The extant is an instrument used to measure angles. It is mainly used at sea, the tool is called this because its bow is one sixth of a circle - 60 degrees. It complies with the principle of double reflection and can count angles to 120 degrees. Practically, the sextant bow is a little over 60 degrees, so the total measurable angle is about 130 degrees.

The sextant is a basic tool for navigation and is used to measure the angle between the horizon and a visible object or two objects at sea.

The strap shall be used to measure the following:

- Vertical angle of hexada (VSA)
- Horizontal angle of hexada (HSA)

- Altitude

B) In general

Principle of bancation:

- When a beam of light is reflected by a plane of rear-view mirror, the angle of the adjacent radius shall be equal to the angle of the reflecting radius when the radius and the reflecting radius are at the same level
- When a beam of light has two successive reflections at the same level by two flat mirrors, the angle between the adjacent radius and the reflecting radius shall be twice the angle between the mirrors

Different parts of a Sextant

One handbag has the form of one sector (60 degrees or 1 / 6 of a circle). It's why the navigational instrument is called Sextant (the Latin word for 1 / 6 is Sextans). The section in a sector-shaped section is called a box.

A horizontal mirror is attached to the frame, together with the index mirror, the shadow glasses (sun shade), telescope, calibrated scale and drum meter meter.

Errors of the extant:

Errors can be classified as

1. Adjustable errors (adjustable on board) and

2. Non-adjustable errors (non-adjustable on board)

Adjustable sextant errors:

- Perdicularity error: This is caused when the indicator is not perpendicular to the level of the instrument.
- Side error: This is due to the fact that the glass horizon is not perpendicular to the level of the instrument.
- Index error: This is caused if the indicator mirror and glass horizon are not exactly parallel to each other when the indicator is set at 0 degrees 0.0. In fact, this is the difference between the optical zero of the spacer and its rated zero, called OFF of the arc if the visual zero is at the right of the rated zero and is called ON of the arc if the visual zero is left of the rated zero.

There are three methods for obtaining an inventory error of a hexagon:

A) Observing the horizon: Tightening the indicator at 0 degrees 0.0, and, holding the hexagon perpendicular, we look at the horizon. The reflecting image and the immediate picture must appear on a perfect line. If not, we turn the micrometer back until it's exactly the same. Reading the micrometre, ON or OFF of the arc gives IE

B) Observing the star or the planet: We're tightening the marker at 0 degrees 0.0, and keeping the hexagon perpendicular, we're looking at the star / planet. The reflecting and immediate picture shall coincide. If not, we're going back to the micrometer until they do. Reading the micrometre, ON or OFF of the arc gives IE

C) Observing the Sun: We adjust the index to about 32 "in the bow. We keep the hexagon perpendicular and look at the sun, using shadows. The reflected image of the sun will appear under the direct image. We're shooting the micrometer until they touch their closest limbs. We note the reading on the bow. We set the marker on the 32'OFF of the arc and look at the sun. The reflected image of the sun will appear above the immediate image. We're shooting the micrometer until they touch their tight ends. Note the reading of the arc. IE is the name of the reader with a higher numeric value.

- Collision error: This is due to the fact that the axis of the telescope is not parallel to the level of the instrument. The telescope is attached to the component in such a way that it cannot lean.

Non-adjustable sextant errors:

- Centring error: It is caused if the axis of the index line is not located at the geometric centre of the arc. This may be due to a manufacturing defect or an unexpected handling.
- Shadow error: The shades must be positioned so that their glass surfaces are normal in the light rays passing through them. If not, the distortion will result. The larger number of used hues, the greater the odds of distortion.
- Optical errors: Caused by prismatic errors of mirrors or deflections in the telescopic lens

Indicators relating to the use of the extant:

- The errors before use will always be checked
- Focus the telescope looking at the horizon and make a mark on the circumference of the stem
- During use, we keep the sextant steady. For this, we stand on foot slightly off for balance with the arms that keep the sextant steady
- Observing the altitude of a celestial body, we turn the sextant on the other side, the body will appear to move along the arc. We measure altitude at the lowest point in this arc
- We stand as close as possible to the main line of the ship
- We use appropriate dark shades while observing the sun
- If there is a reaction error, turn the micrometer in one direction only
- The heights of stars and planets shall be taken in the twilight
- Night feedback should be avoided as far as practicable. The bright light of the moon gives the illusion of a good horizon that is likely to be false
- While observing the HSA, set the pointer to zero, look at the object to the right through the telescope, gradually move the pointer and finish while looking at the object to the left
- When the VSA is measured, we look at the top of the object, adjust the index to zero and look at the top of the object. VSA = height of object in measures.

EPILOGUE

Marine electronic media refer to electronic devices designed and classified for use in the marine environment on ships and vessels where even small drops of sea water can destroy electronic devices. Therefore, the majority of these types of appliances are waterproof.

On Electronic navigation devices include Cartography, VHF maritime, automatic steering wheel and automatic direction tools, marine radar, GPS, fibre Optic gyro.

On the basis of all the above, we can understand that the electronic means that help the proper operation of the ship are used for two reasons: Firstly, to steer the ship without problems, and secondly, to avoid serious dangers from which the ship itself and the surrounding environment could be endangered, as well as other ships.

BIBLIOGRAPHY

Zechariah Chukulas (2006). Maritime Electronic Instruments. Athens 2006

Zechariah Chuglas (1999). Radar operation - Footprint Helps. Athens 1999

Zechariah Chuglas (1999). Radar. Athens 1999

Margarakis John (2013) "Maritime communications" Panoric Group of Ionian Sea Shipping

Letter A, (2006), "Electronic Charter Systems." SLAD.

Kallurst A. H., Katholis W. I. and D. A. Dalaklis (2008). Nautical Electronic Instruments Athens

Psilas A. (1961),"Radionavigation Aids ". Athens.

Paul Williams ed al. (2008), "e-Navigation and the Case for e-Loran", Journal of Navigation vol 61, 473–484.

Cutler, Thomas J. (2003). *Dutton's Nautical Navigation* (15th έκδοση). Annapolis, MD: Naval Institute Press

https://www.eef.edu.gr/media/2563/naytika-ilektronika-organa.pdf