ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ

ΤΜΗΜΑ ΠΛΗΡΟΦΟΡΙΚΗΣ

ΑΝΑΣΤΑΣΙΟΥ ΙΩΑΝΝΗΣ

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ΝΑΥΤΙΛΙΑΚΗ ΠΛΗΡΟΦΟΡΙΚΗ

ΛΟΓΙΣΜΙΚΟ ΣΕ ΠΛΟΙΟ

Introduction

In recent years, the need to upgrade the quality of shipping services is greater. By lowering costs to information services, companies have made the difference to transfer it to quality services. Most, if not all, shipping companies in Greece and around the world have installed information systems.

An integrated Information System in a shipping business records and monitors its movements both at sea and land. The amount of information exchanged by the company with the port, with suppliers, customers and other stakeholders is very large. At the same time, it is perfectly understandable that management wants the amount of information to reach the recipient in a very short time.

The Information Systems have undertaken and carried out many of these functions, which need a shipping company and continue and evolve.

The Marine Business Sector in Greece

Due to the structure and geographical location of Greece, the shipping industry has become large in many areas. Shipping is one of the most economically growing branches in the country. Since 1990, it has significant expansion rates and rates high and comparable to those of the most developed countries in Europe and the Far East.

The action of shipping companies has been strongly reported in both the Greek and the world. The contribution to the development of the national economy is also strong. However, the need for continuous and immediate information is passed on to a higher level.

Business governance structures in the maritime sector, worldwide, are trying to differentiate themselves from traditional models. In each Maritime Organization, Management needs, with simpler methods, to continuously control operations, charters, financial administration, safety, technology, the environment, nautical policies and regulations. The economic growth of traditional industries and the parallel upward movement of the Far East economies have prompted a long-lasting turnover. The sailing market continued its upward trend in both dry and wet cargoes. Since 2000, Greek shipowners have continued to focus on bulk or bulk shipments, with nearly 60% of the Greek fleet specializing in this sector. According to the United Nations Conference on Trade and Development (UNCTAD) annual report, which, in collaboration with the HIS Fairplay database, processes data for the world merchant fleet of 1,000 gt and above, Greek merchant shipping maintains, and in 2017 , ranked first in dwt, with Japan ranked second, and Germany, China and Korea completing the five.

Considering the above facts and knowing that most of the international trade in terms of volume is transported by sea, it

is easy to see the role of Greek Merchant Shipping in International Trade.

MARINE, BENEFITS AND DEDUCTIONS INFORMATION SYSTEMS

The use of new technologies, the organization and use of maritime information systems has brought significant changes and benefits to a generally traditional industry. In terms of shipping processes, the benefits are multifaceted and relate to recording and direct access to useful information, accelerating and improving communication with suppliers and partners overriding geographical distances and safeguarding crew and ship safety. The above results in increased productivity and better control and upgrading of the services provided. Very important are the benefits at the company's internal level. Centralized control of applications and users is supported and employees can be evaluated based on their efficiency. Improving financial management reduces management costs and minimizes operational risks. Issuing final reports on the various processes that are being carried out helps to better supervise, export fertile conclusions, and enhances decision-making by management structures. Lastly, it is important to note that the contribution of new technologies and systems is crucial to the adoption of environmentally friendly processes and the reduction of pollutants.

The use of information systems includes some drawbacks that prevent shipping companies from getting the most out of information systems. The main disadvantages are the non-use of some universal standards that would facilitate communications and information exchange, the high cost of implementing integrated software solutions, and the incompatibility between the various applications used by the

parties. The maritime sector by its nature involves a huge variety of interactions between stakeholders. Shipowners, charterers, brokers, manufacturers, distributors, government agencies, international organizations, port authorities, shipyards, suppliers, agents are some of them who need to interact without having defined standards in communication with each other. Each of the above uses its own application and follows its own standards in communication and in the way it exchanges information.

Providers of software solutions in an effort to address the problem but also to upgrade their services attempt to offer a high degree of compatibility of their applications with the rest of the market or a high degree of integration without this attempt to is always successful. (Rolakis, 2013)

SOFTWARE

Computer software or software is defined as the collection of computer programs, procedures and user instructions that perform certain tasks on a computing system. The term includes:

- the application layer software, such as word processors, performing productive tasks for users,
- the system software layer, such as operating systems, providing the necessary hardware services in the application software,
- the middleware, which controls and coordinates distributed systems
- the hardware layer that low-level hardware programming of a computer or its peripherals. (Wikipedia, 2017)

The term "software" is sometimes used in a wider context to describe something that is not material but used with material such as movies, music discs, and CDs. Computer software is what counts as not belonging to the computer hardware. The material includes objects that are material, and the software includes intangible programs and applications inside the computer. The software covers a wide range of products and technologies developed using different techniques such as programming languages, formatting languages, etc. Different types of software include web pages developed with HTML, CSS, PHP, Perl, JSP, ASP.NET , XML, and applications that run locally on a system such as Microsoft Word and OpenOffice, developed in C, C++, Java, C #, etc. It is typically run over an operating system (which is also software), such as Microsoft Windows, Linux (with GNOME or KDE) or Sun Solaris. Also, software usually works on a software platform provided by either the operating system or independent platforms such as the Java platform and the .NET platform. Software written for a software architecture or platform usually can not work on other platforms, for example, Microsoft Windows applications will not be able to work on Mac OS because of platform-related differences and patterns . These applications can work only if they are transferred, using an interpreter or porting the source code to that platform. The software used on ships is usually closed-source and depending on what functions the ship needs, some parts of it may be disabled (for less cost).

The software is usually available on disks for easy storage and archiving.

SOFTWARE ON THE SHIP
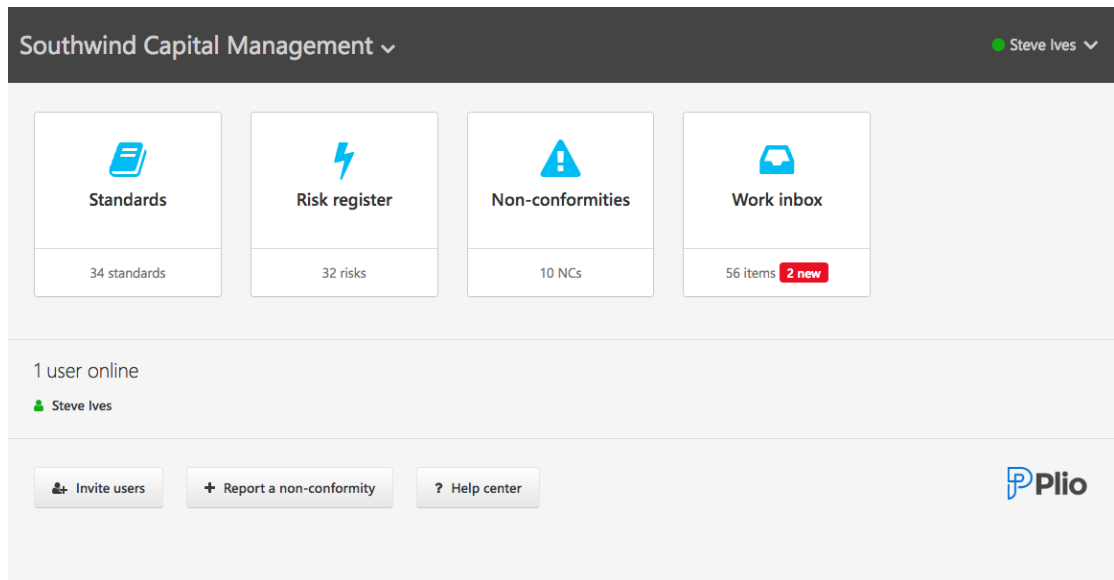
The management of a ship is shared between two entities that play an equally important role in its smooth operation. The first concerns offshore operations and operations (office) and is usually related to its organizational and financial management. The second is the ship and its crew, which is responsible for the handling of the trips and the technical maintenance.

These two pieces are interrelated and work closely together to achieve the goals and the activity to be profitable.

The communication and exchange of information between these two parties is particularly important and was, from the outset, the basic need to cover the software that was developed. The operation of management software can be summarized as follows:

- System users on board ship to enter, update and manage information and data related to current processes carried out on it.
- They then extract some results from which they will either take action or are promoted to the office for further investigation.
- The Office in turn should evaluate these results and jointly plan the next actions.

Due to the lack of ship infrastructure, the low level of crew in handling computer programs and the high cost of communication between the ship and the management office, the software initially used was usually simple forms which did not require any particular computational knowledge or some training. The operating model was relatively simple and comprised of stand-alone computers at different points of the ship (bridge, captain's office, engineer's office, etc.) without any connection between them and without any terminal, capable of sharing resources, managing and storing security of valuable information. The crew brought the data on the ship and the user entered the data on the computer. Even transferring files from one computer to another was done with various storage media. This resulted in software solutions used being poor in performance and limited capabilities. However, with the evolution of telecommunications and the Internet, it is now possible to connect the computer stations within the ship but also with the central management system. The individual parts of the ship can communicate and exchange data in real time with speed and security. The information they manage covers a wide range of financial management, staffing, refueling, maintenance, fuel consumption, ship performance, and more. To address compatibility problems and an attempt to create

independent apps accessible to everyone, software companies are focusing on creating relevant web applications and platforms. The adoption of such systems enhances their universal use and enables direct communication between an organization and that with other external collaborators.

The 9 main categories of services offered (functional approach)
- Communication software
- Technical monitoring and maintenance of the ship
- Quality and Safety Management Systems (ISM, ISPS)
- Stock monitoring
- Electronic supplies / orders
- Operations / Voyage management
- Managing human resources - Crew
- Integrated systems
- Electronic Shipping Markets
- Digital maps

RISK OF USE OF SOFTWARE
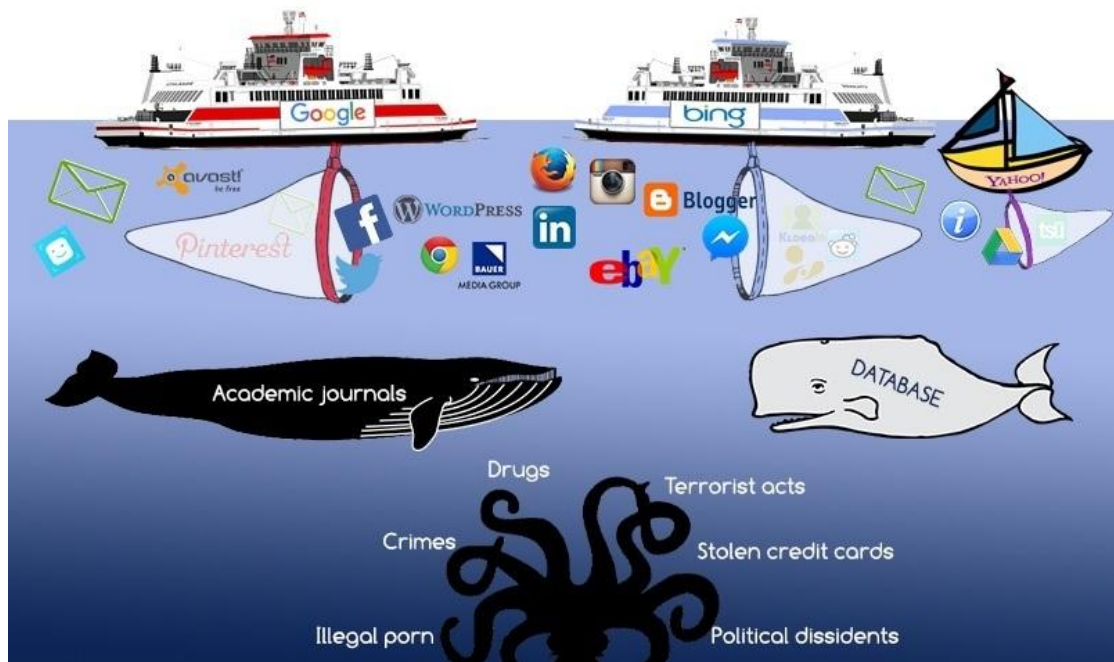
Hacking Ships: The shipping industry is at risk

Modern ships are considered a prime target for hackers and pirates that increase their attacks on the shipping industry.

Modern marine vessels are often monitored and controlled by facilities dry thousands of miles away to ensure efficiency. This creates a new platform for hackers and pirates to conduct targeted cyber attacks on ships.
Multiple safety studies show that the shipping industry faces a major risk of cyber-security. Information Technology has played a very important role in the shipping industry. Today, modern ships are fully computerized. Everything is

connected to networks. Modern ships have complex cargo handling operations that are totally connected via cyberspace. The cranes are moved through GPS systems.

"Cybersecurity is a security issue. Every ship built has software that manages its machines, this software is updated when the boat is moving away from the beach, and the Captain is not even aware of the software update, "said Rear Admiral Paul Thomas of the US Coast Guard. Hackers could affect ship control, shut down their navigation systems, interrupt communications, or steal confidential data, according to the Allianz Global Corporate & Specialty SE's 2015 Safety and Shipping Review. "Crew is getting smaller, ships are getting bigger, and a growing dependence on automating all the processes greatly exacerbates the security situation and increases the risk of hackers to disrupt the core systems," the report said.

Increased use of computerized systems for navigation, cargo inspection, rapid unloading, goods distribution and freight traffic in ports makes them vulnerable to cyber threats if appropriate security controls are not implemented.

Cyber threats to the shipping industry are divided into five main types. Threats to:
• Ships and safe navigation
• Satellite communication
• Load monitoring systems
• Marine radar systems
• Automatic recognition systems

Many cyber attacks have taken place on merchant ships in the past. In such an incident, a US Army merchant ship was the target of an attack by Chinese hackers allegedly acting as perpetrators. In 2012, the Chinese Army threatened

"multiple systems" on a Transcom merchant ship. Shipping providers were also the target of spear-phishing campaigns.

These attacks use misleading emails that target a particular company to gain secure access to confidential data. Similarly, KPMG has collaborated with a major shipping company that has been the victim of a deliberate hacking attack, possibly from a competitor. Hackers recently decommissioned a floating oil rig, while another rig was so full of malware that it took 19 days to become trusted again. Somali pirates chose their targets by viewing online navigation data, causing the ships to either turn off their navigation systems or transmit false data so they seem to be somewhere else. Hackers penetrated computers connected to the Belgian port of Antwerp, where special containers were located, smuggled drugs and deleted the files.

The GPS expert, Todd Humphreys, a professor at the University of Texas, has demonstrated that simply using a cheap device consisting of a small antenna, a $ 3,000 GPS "spoofer" and a laptop, is able to take full control of the sophisticated navigation system of a super-yacht over 210-foot in the Mediterranean Sea.

Reducing cyber threats

Unfortunately, many cyber-events in the shipping industry have remained unnoticed or businesses do not want to reveal them publicly, say security experts. A spokesman for Maersk Line, the world's leading shipping container company, said:
"Yes, we consider cyber risk a threat, but ships are not more vulnerable to such attacks by onshore systems and organizations. We take this danger seriously and make sure that we are protected from such threats. "

The shipping industry must incorporate the right defense into its strategies to be able to handle cyber threats. Applying appropriate defense includes thorough checks, such as:

- Install antivirus software
- Policy for the safe operation and maintenance of the system
- Safe design and development of applications and systems.
- Raise awareness of employees working in the shipping industry
- Ensuring ports that use primarily automated cargo handling systems.

The shipping industry should follow security rules and standards at all levels of the organization.

BIMCO and CIRM (Comité International Radio-Maritime) have sent IMO the first international proposal to adopt standard ship maintenance software. According to the BIMCO announcement, without the use of standard methods, the chances of undesirable occurrences on ships are greatly increased, which may lead to cyber-security problems and thus may cause significant economic damage.

In BIMCO's announcement, BIMCO's Angus Frew, Secretary General and CEO states that "we hope the entire shipping industry will adopt these standards to make ships safer and to prevent any cyber attacks."

The purpose of the "Standard on Software Maintenance of Shipboard Equipment" is to ensure that ship software updates are routinely and safely, while facilitating the communication of the various members involved in the process and future maintenance planning.

These templates include user access to a complete list of software versions that use the ship's individual systems, making it easier to restore to a previous version when and when required.

It is noted that BIMCO and CIRM are hoping to introduce these standards as versions of international ISO standards in order to make them more effective, while a BIMCO working group is already working on completing the standard shipping software maintenance methods, which is expected to be completed by in 2021.

How Information Technology Changes Greek Shipping

Innovative technology solutions for shipping, processing and analysis of data to and from ships have been presented by the largest companies and, as they all suggest, many of the functions that balance between offices and ships will be simplified, saving time and money.

Fortune Technologies, a provider of software solutions and professional services to shipping companies, presented in collaboration with Microsoft the new Microsoft Dynamics NAV 16 solution. It is a network-based innovative enterprise-based (ERP) system that makes it easier for ship-to-office communications. Through this system, it provides solutions related to the management of finance, purchasing, procurement, personnel management and payroll, etc. helping departmental managers to quickly take decisions to reduce risk. At the same time, it works like all Microsoft software that users are familiar with and is now available on mobile devices such as smartphones and tablets, which, as employees say in the industry, will "solve their hands" once they can access and control over much of the ship's operations.

ABS Nautical Systems introduces a software that allows the ship to be monitored during the voyage. This means that its energy performance, its status and the full range of its functions can be controlled as long as it is at sea. The forefront of sophisticated software is not so much the collection of these data, which is certainly very important as the bureaucracy is reduced and many procedures are being automated to date. Real innovation comes from automated data analysis. (Stamatis Fraudos, Principal Engineer). The data, on the one hand, is collected and calculated by the software, with the result that monitoring and coordination by the offices is made faster by helping decision-makers.

DANAOS Management Consultants presented its new products: the "WAVES fleet performance management system", ship performance management tool and the DanaosONE networking platform. The "Waves" awarded with Lloyds' Big Data Awards, is software that sensors, real-time data capture, process and rationalize them according to the planned algorithms. In the logic of "fog computing," data on procurement, fleet management, consumer and safety issues go through the processing formulas and then transferred to the IT department of the company as

information. This saves large amounts of money that would have been spent using the traditional time-consuming and manual way of collecting and transferring data to and from ships. Danaos also introduced the DanaosONE platform, a collective online service tool, something like Linkedin's shipping (Christos Emmanouilidis, Business Development). It is a Business to Business platform accessible only to registered users whose e-mail addresses have a maritime-related domain and are also open to students and graduates of corresponding university departments. The purpose of DanaosONE is to bring together the entire shipping community to promote the replacement digital process, the open dialogue between people in the area, the search for staff and work. The sophisticated INFINITY Cube has been revealed to the public by Navarino in collaboration with Dell. INFINITY filters and compresses the data through "airtime", that is, very simple, talk time and network data volume. The communications provided on the ship are connected to the terminals and the internal network by controlling the data - ie the data flow - minimizing traffic which was a problem for ships' costs (Dimitris Kourtidis .Presales engineer). The boat does not, in this way, ever live without bandwidth, since INFINITY intervenes and "cuts" the unnecessary communications, opening the necessary ones respectively.

Inmarsat is ready to launch Global Express (GX), the new satellite that combines fixed communications and fun for the crew at low cost. The new satellite will provide broadband fleet telephony services, replacing the old systems that will allow you to work in the ship, seamlessly even remotely. It also combines the VSAT functions used so far to access the crew's telephone and network during the trip, which was overwhelming. Global Express merges these two axes with a fixed "satellite dish": business network and crew coverage,

in very good quality, with a given charge that solves the problem of very expensive bulk.
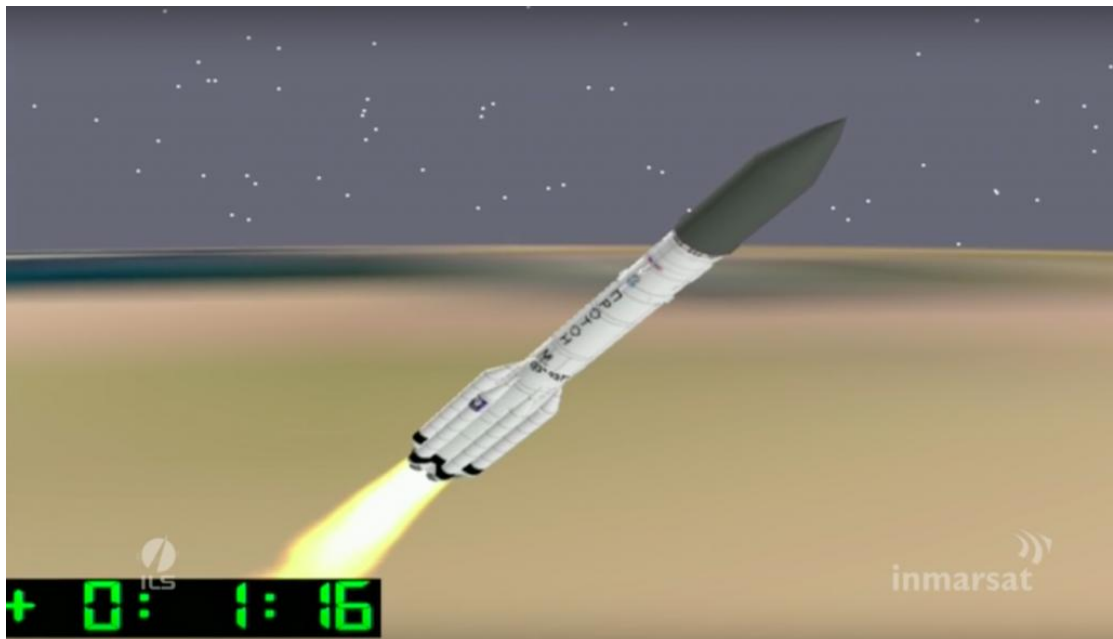
Technological tools serve to normalize and refine the information systems used in the shipping industry by addressing the issue holistically by providing end-to-end solutions.

LAROS is an integrated wireless collection and analysis system for fleet performance based on innovative hardware and sophisticated software. The unique LAROS data collection structure allows for rapid installation along with increased flexibility in connectivity and sensor interfaces. Adopting the Laros system, a shipping company acquires a full and thorough knowledge of the fleet status in almost real time and therefore enjoys among others: Automated Reporting, Hull and Propeller Performance Monitoring, Main Engine Monitoring, Voyage Parameters Monitoring and Optimization Regulatory compliance. It can also feed data from any ERP or other information systems that a shipping company may have.

The Laros system is installed and operates on hundreds of ships of Greek and international shipping seafarers providing self-knowledge of their operations to the shipping companies that have adopted it, contributing to their better energy efficiency and helping crews to manage their operations more easily.

CONCLUSION

THE FUTURE OF THE SOFTWARE
As shipowners and managers realize that the software should be selected in accordance with the management principles, senior managers assisted by IT managers are the ones who will take responsibility for the decision in their own hands . Additionally, IT professionals in shipping will gain more experience in ship management issues, making decision-making much more immediate and more reliable than it is today. That is, the difficulty and confusion that arises in selecting software will make it clearer with the awareness of how insignificant this technology is in itself if it is not linked to real goals of the shipping business. Fortunately, this confusion begins and worsens, as it was many years ago and with technical decisions. The IT technician will become even more important in the ship management company. In the past, a reluctant audience had to be introduced to the basics of information technology, and now it will make it easier for commercial managers to make decisions.

IT and IT managers in shipping and many other industries will really become experts in terms of productivity. This will be fully in line with the awareness - which shipping managers will soon acquire - that these are the experts who will determine the order of priority to solve productivity problems, while Information Technology and Systems specialists will indicate the technical solutions that work

effectively and proven. Also, funds for IT systems will be made available more easily and the effort will now focus on using technology to improve its efficiency.

The next-generation software will focus on how the system will collect and interpret information stored in individual software units so that they are useful to those whose primary concern can not handle these units. For example, a failure affects not only the technical performance of a company, but also has an impact on business. The Director-General needs to have comprehensive information on issues arising after such a failure. Therefore, as more and more senior managers will use software systems, such as nowadays, have started with i-phones or similar personal productivity devices, the need for a more user-friendly system will be so great that it will promote the creation of a new industry in the software industry.

Sources:

- Danaos
- Fortune Technologies
- securityaffairs.co/
- http://www.cyberinsurancegreece.com/ereynes/naytilia/
- Λογισμικό Φόρτωσης - Εκφόρτωσης Υγρού φορτίου (Μπρέκη Ελένη, Σαράντη Αικατερίνη, Χριστοπούλου Ειρήνη)
- Bimco.com