Research paper

Safer boat technologies to prevent accidents

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The purpose of this research paper is to prove how engineers and scientists can improve boats safety system in order to respond the need of boat manufacturers for safer and securer products. These last years the number of hijacks, fatal accidents and damages caused by natural catastrophes to ships and boats has increased, hence a need for improving sea navigation safety technologies is nowadays explicit. Several sea regions around the world are dangerous due to the presence of pirates, Somalia for example is a good example of this, in this region in order to not be visible boats and vessel have to turn off their position signals. On an additional note one could also argue how nowadays people is becoming more concern about pollution and those effects cruises and ships could have on the environment thus it is for this reason that this research paper would also argue the sustainability of electrical engines. To better the safety condition on ships and cruisers the following improvements need to be done: Better safety systems, better communication tools, 3D printers on board, electrical engines, ecological innovations.

Because of people enjoying boat related activities consumers using this product either on a private or commercial way have interest into improving the safety condition of their ships. Boats can be a real pleasure for those who are passionate about navigation and the sea in general. Sailing with boats can be a good activity involving lots of fun but if done in the wrong way, or if being taken by the wrong circumstances, sailing can easily turn into something fatal and extremely dangerous. A good example of this is for instance the crash of the "Costa Concordia" near the "Giglio" island on January 13, 2012 (http://www.bbc.com/news/world-europe-16563562, BBC News). The crash, happened due to a human error, caused the fatal death of thirty two passengers on the boat and became famous worldwide. Let's take another example less recent but still known by people the "Titanic". The Titanic was a ship that crashed into an iceberg and flooded into the ocean causing the death of almost every passenger and crew member. The

sinking of the Titanic was due to a lack of effective security systems that for example nowadays technologies provide to modern ships and cruisers. In the first example was the captain the cause of the fatal incident; however, this does not meant technology cannot influence the safety condition of boats, as we have seeing for instance in the Titanic example. Every month, week or day during summer time, newspapers, TVs and websites publish on their news the crash of thousands of boats in which humans are in most of cases the cause of them. People have to know that on the seas or oceans everything can happen in a short period of time. Safety is really important hence during the last years boat technologies have been improve to become safer and more reliable. This research paper will be about two main different types of boats: private yacht and freighters. This research paper will speak about how the technology of ships and boats was improved and how it helped people to manage in a safer way their boats. The need for boats manufacturer to improve boat system and navigation has increased due to the number of hijacks and human error deaths on commercial cruise ship, natural catastrophes to provide significant improvement on these types of transport vessels: safety and security projects onboard, better communication, 3D printers on board, electrical and more ecological engines, innovations and resources.

People travel every day through oceans and seas, thus their security is very important because they risk their life at any moment. In the middle of the ocean, everything can happen as said before, even if they have a strong security system on board. Security messages are very important on emergency circumstances, with this system each boat can contact the office at the port and ask for help if needed. The way this work is that the boat sends a message on the general distress service and the message will be receive not only by the port office but also by all the boats around the one who have a problem. Due to the law every boat receiving a distress message

has to help the one in danger and only if not having the right tools and equipment to assist the boat in danger the miss intervention can be justified. For several years most of the boats were not well equipped with safe technology, sometimes for instance they did not have the right antennas to get some of the signals sent to them. Nowadays they begun to be more equipped; they started to have bigger antennas which can cost several thousands of dollars each. Let's take the first example on private yachts. They are own mainly by the richest people in the world. Hence because being rich these people want to have the latest technology devices and system on their boats. Even if being wealthy and not in commercial boats, it happens frequently that the owners of these boats need a radio connection for personal needs. Communication on board is very important for safety conditions and for boat owners because it is thanks to it that they can communicate in emergency cases and not only. Let's get more specific and clear about communication evolution these last years. Boats use the GSM System in order to communicate. They also use the AIS system (Automatic Identification System), this system shows the marine traffic on time on each ocean in the world, with this systems people can localize boats in bad condition but in certain part of the world like "Somalia" where pirates are boats have to cut the signal in order to be invisible. (http://www.aisonvhf.com/). In order to send warning messages boats and vessel need some antennas which considering the environment where these ships are being used need to be of good quality. Satellite antennas in such applications require gyro stabilization in order to accurately receive and transmit messages and data. Communication is very important for vessels to prove and describe their positions.   (http://www.watson-gyro.com/aps/satellite-antenna-stabilization.html)

New small remote-controlled robots and safety systems came out to help avoiding accidents and human errors. During the winter, the vacation period for most cruisers companies,

boats are stoked in dry-docks. Boats must have an annual maintenance on their engines, under the boat and the hull. These operations are often made during the winter season. The process works in the way that employees dive under the boat to check the hull in look for holes or cracks which could cause serious problems during sailings. This technique is useful but very dangerous for those going under water. Let's take an example of an accident that happened recently, three submarines went under a boat to check on a crack and tried to repair it. There was bad communication with the crew on board and the submariners did not know it so they continued the reparation process. After several hours, two of them separated and went to the front; the last one remaining went back under the boat to repair one propeller. Because of the lack of communication the crew on the boat was sure that all the submariners where at the front of the ship, the engines were turned on and the submariner got aspirate by the propeller and died. The communication between craws on the boat and the people going under water is hence very important.

3D printers on board will help owners and crews make missing or broken parts during a cruise. A new technology useful for boats is 3D printing which just arrived to the boat industry. Very often problems happen when the boat is in the middle of a cruise. When these problems happen the company and the boat has to join the closest port in order to change, repair or even replace the broken element. With the new technology of 3D printers on board, there would be no more need to join a port. When needing to go out of route the company loses a huge amount of money and precious time. And in some cases manufacturers of the product does not have the missing part in the inventory, hence the company has to order it and wait provoking a bigger delay. Thanks to 3D printers ships would be able to ask for blue prints to the company producing the missing parts and then print them on board. This would allow companies to gain money and

time. Even if considering the high prices of 3D printers the investment would be amortize in the long run. Using these 3D printers on board would help builders and owners of vessel to be more flexible if they have a problem with some of their pieces to replace. In addition its take less space on board because they do not have to carry all these pieces which sometimes can be really big and heavy. Because of taking a lower quantity of tools and objects with them on board ships would have financial benefits from this technology and easy the reparation processes.

New types of energy could help to avoid the bad consequences and risks of using oil. Ecological solution on board is the new solution of the energy dilemma on boats today. First of all, the consumption of oil cost of lot of money for companies and organizations. Let's take an example, the Queen Mary 2 has a Fuel Capacity of 4,381 metric tons which equates to 41 feet per gallon (http://cruises.lovetoknow.com/wiki/How_Much_Fuel_Does_a_Cruise_Ship_Use). The Queen Mary 2 (QM2) is currently the fastest ocean liner in the world. It weighs 151,400 tons. Still, at a clip of 32.5 knots, the QM2 can sail for 10 days on a full tank. By a simple calculation, some results come out: 4,831 tons times 1,000 times 1.2 equal a cost of $5,257,200 per travel. (http://www.prix-carburants.gouv.fr/). The calculation uses the capacity of the boat multiplied by 1,000 in order to be in liters and then multiplied by the price per liter of oil. Furthermore, beside the cost of these energies, the use of oil on ships can cause enormous ecological disasters. If someone compares a boat cruise and cars, the results show that one boat cruise equal 62,500 cars thanks to this calculation: 4381000/70 liters= 62.500, this number represents the number of cars people can fill with all the oil that can a big vessel can contain. Let's take an example of catastrophic event. On the 5 October 2011 the "Rena" oil spill happened and it quickly became the biggest oil spill crisis that ever took place in New Zeeland. (http://www.nzhistory.net.nz/culture/shipping-containers/rena-disaster). In this case the vessel has

leaked between 130 and 150 tons of oil. The environmental groups around this accident and the bay with plenty of residents were preparing themselves for an ecological catastrophe as oil continued to wash up the region's beaches. The boat can contain 1.700 tons of oil on board, which is just an incredible amount. In this case authorities state that in order to "repair" and solve the crisis weeks or months would be needed.

According to different studies, electronic systems are becoming more and more present for yachts and boats market. Studies show that a vessel consumes lots of oil and electric energy, engineers and scientific try to create and promote a new way of using electrical power in order to reduce the consumption of oil. By making previous tests they saw that trying to put two different engines on board can reduce a lot the consumption of oil. People can see in magazines, innovations such as electric boats or solar boats which made a cruise around the world with just the sun as source of energy. Making this test on big vessel could not be possible because their energy demand is too high. By using electric energy they would consume less energy during speed variation which is the moment when vessels consume the most.

New types of hull rounded section at the front of ships help manufacturer to consume less fuel and also increase ships stability on the ocean. Thanks to technology innovation there are new types of hull in the market. First, the typical hull for a boat is in spades which is make for break waves in order to have a better speed cruise. This design of hull will help boats being more stable and safe in rough seas. In addition with this type of hull builders will consume less oil because the boat will not break the waves but go and glide through the water.

"S.M.A.R.T Yacht" is a new project for a near future. This project is an innovation in the market. First of all, let's start with the meaning of SMART Goals which means specific,

measurable, achievable, relevant, and time-bound. Specific goal objectives should address the five Ws (who, what, when, where and why). Measurable goals should include numeric or descriptive measures that define quantity, quality, and cost. Achievable means that the team needs to do everything in their power to achieve the goal. Relevant is why is the goal important? The last one is time bound should identify a definitive target date for completion and for frequencies for specific action steps that are important for achieving the project. This vessel will be more ecological it will consume less oil and more electricity. By consuming more electric and using new systems on board, it will be more efficient. One month ago, a conference spoke about this project, in Antibes with the administration "international superior society."

Computers control could go some way to making cargo ships cleaner and more efficient. Nowadays, cargo ships carry the bulk of the world's trade, but are a major source of pollution. Today at any given moment, every day there are more than 55,000 cargo ships everywhere, plying the world's oceans. These cargo ships are transporting the goods and the groceries, fuels and food, cars and computers that form the backbone of global trade. However beside their usefulness of carrying everything that people need every day, they also carry a heavy environmental cost when it comes to carbon emissions. They are very far from our big cities, from where most of people live, so less visible than our pollution-belching industries and motorways block in the middle of the traffic, giant cargo ships are also adding their considerable carbon footprint even a lot more than cars and industries. Let's take numbers, in the last 15 years; container ships have greatly increased in size. In addition, according to Matt Collette, who teaches ship design at the University of Michigan in the United States, they were becoming five times bigger than before. The world's largest ship, is the Triple-E, operated by Danish shipping giant Maersk is 1,320ft (400m) long, which represent almost the length of four football field,

240ft (73m) tall and 194ft (59m) wide. These types of cargo ships can carry 18,000 standard 20-foot containers. For instance, if those containers were placed end-to-end on a standard train, that train would be nearly 70 miles (110km) long; it is just incredible. Furthermore even those giant vessels like the Triple E may only be staffed by a crew of only 20 people. This little group can manage a giant ship; lots of innovations today are created for cars and trucks. People and engineers create new types of automation advances in order to make these products safer that could also be used to improve ships, even ships of a big proportion as this one. These giants vessel could in theory run around the oceans without any crew at all; they can be either fully autonomously or under control from a central ground station. The best option is under control from a central ground station, because fully autonomously can be dangerous if the system has any problem. According to Collette, professor at the University of Michigan, there are *two primary drivers for automation*. One is that human beings are not very good at long *repetitive tasks* which are of course what a long ocean voyage is. "That's when you see lapses in concentration that lead to the ship getting into a collision or running aground," he explains. "Automation could reduce those types of accidents significantly, because the computers have no problem paying attention for a two-month voyage." "Human error, solely or in part is the cause of more than 75 per cent of today's vessel accidents" (Stewart, Jack, BBC)

Finally, these ships could be operated from a central onshore control center, with a crew as fellow: one person responsible for up to ten vessels, and would only need a 3-4Mbit broadband connection to ensure adequate communication, but also it is better that a second one control what the first one did just before because as studies show human error is the cause of more than 75 per cent of accidents. According to several research and websites the technology for electronic safety, positioning, good communications and anti- collision already exists. (BBC Future)

To conclude, thanks to all these improvements in technology, manufacturers and builders would be able to react and respond more efficiently to the need for safeties boats. Hence improving boat systems and navigation would reduce the number of hijacks and human error deaths on commercial cruise ship, natural catastrophes. By creating and providing significant improvement on these types of transport vessel, new safety projects products with AIS and GSM systems better communication between boats, 3D printers on board which help builders save money and places onboard, electrical engines create a good , ecological innovations and resources. Furthermore, new technology became a goal for all the industry; it is a new trend that everybody wants to use. People who own yachts or big vessels are part of the high class in the society, so they can buy almost everything due to their money and they want all the new technology on their boats and also in everyday life they want the best. Some company like Samsung put a new system controlling kitchen appliances, and it is becoming the same idea on vessels. Moreover, a lot of products are becoming fully or partial automatized due to the evolution of technology. Finally in the medical field studies show that people will be replaces by robots, a good example of that is in some hospitals in China where robots help nurses by handing out medicines to patients. Today, doctors can create new artificial arms, legs and prosthesis, make surgery with computer at a distance away thanks to the technology growth.

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