The objective is to overview the material about new technologies welding used in the shipbuilding. Welding is defined as “a jumping process that produces coalescence of materials by heating them to the welding temperature, with or without the application of pressure alone, and with or without the use of filler metal. Modern welding techniques are employed in the construction of numerous products. Ships, buildings, bridges are fabricated by welding processes. Welding is also used extensively in the manufacture of automobiles, farm equipments, home appliances, computer components, mining equipment. Hundreds of products we use in our daily life are also joined together by some type of welding processes. Before welding, ships were being constructed by using clinches. Currently there are many traditional technological methods used in shipbuilding:

- **Shielded Metal Arc Welding (SMAW).** This method is also known as Manual Metal Arc Welding or Stick Welding. An arc welding process in which coalescence of metals is produced by heat. The heat comes from an electric arc that is maintained between the tip of a covered electrode and the surface of the base metal in the joint being welded [2].
- **Submerged Arc Welding (SAW).** Submerged arc welding is a method in which the heat required to fuse the metal is generated by an arc formed by an electric current passing between the welding wire and the workpiece. The tip of the welding wire, the arc, and the workpiece are covered by a layer of granulated mineral material known as submerged arc welding flux [6].
- **Gas Metal Arc Welding (GMAW).** GMAW, by definition, is an arc welding process which produces the coalescence of metals by heating them with an arc between a continuously fed filler metal electrode and the work. The process uses shielding from an externally supplied gas to protect the molten weld pool [1].
- **Gas tungsten arc welding (GTAW).** Gas Tungsten Arc Welding (GTAW), also known as tungsten inert gas (TIG) welding is a process that produces an electric arc maintained between a nonconsumable tungsten electrode and the part to be welded. The heat-affected zone, the molten metal and the tungsten electrode are all shielded from atmospheric contamination by a blanket of inert gas fed through the GTAW torch [1].
- **Oxyacetylene Welding (OAW).** The oxyacetylene welding process uses a combination of oxygen and acetylene gas to provide a high temperature flame. When mixed together in correct proportions within a hand-held torch or blowpipe, a relatively hot flame is produced with a temperature of about 3,200 °C [3].

Along with traditional methods new improved methods of welding have appeared nowadays. They are ceramic welding, robotic welding.

**Ceramic Welding.** In recent years, especially for the shell plate of the vessels, ceramic welding is being started to be used as a welding technique. The welding is being done by using ceramic weld backings. X-ray quality, full penetration welds from one side and in a single pass can be achieved with this method. On the other hand, finished high quality weld and savings of labor, materials and time are also been achieved [1]. Weld backings can be used to compensate for poor fit-ups, and is valuable when welding conditions are not ideal or where the back side of a weld joint is inaccessible. In the ceramic welding the welder should do root opening. Then backing is applied on the material and welding starts. After finishing welding process, ceramic backing should be removed. This method is applied for welding of the shell plates of the ships. High quality, full penetration, time and economical savings can be achieved with this method. Therefore the delivery times of the projects are being shortened [5].

**Robotic Welding.** Robots are used in a wide range of industrial applications. The earliest applications were in materials handling, spot welding, and spray painting. Although the automotive industry is the major user of robotic welding, the usage of robotic welding is also improving in the shipbuilding industry day by day. The two basic welding types in shipbuilding are spot welding and arc welding. Arc welding robot is one of the most common functions in industry today. During this process, electricity jumps from an electrode guided through the seam, to the metal product. This electric arc generates intense heat, enough to melt the metal at the joint. For the robotic arc welding system, much more controller is also required. The automated welding has begun improving upon manual welding in the industry due to increasing speed, quality and throughput. The shipbuilding industry is suitable for the robotic welding. The robot welding automation is much safer and more cost-effective. The welding can be done completely at the unreachable areas. Due to the automation, the faults regarding human factors will not be come across with this method.
For the first time in the world the compact and intellectual welding robot which intuitively and automatically does welding works, was designed and developed. Robot beforehand knows which welding work it’s going to make. It knows what kind of features of welding construction it’s going to meet in the process, and after it defines these features through its sensors it starts welding according to the rules. The robot observes the whole welding process [2].

In case of service (for example cleaning or changing the oil) process is being severed and robot automatically moves in the service position. Here the operator does the whole service. Then robot comes back to the position to renew the welding process. That’s why the use of robot needs the minimum of operator’s preparation. It guarantees optimal work. One operator can work with 4 robots at the same time using the simple user interface. Have entered a new period, and have opened possibilities which seemed impossible only some years ago. Our European partners managed to establish new standards for application of the welding robot for the heavy industry by system engineering which isn’t limited to classical rules and traditional technologies [1].

In understanding of all area of welding, «Inrotech» has developed a product which combines high technologies and simplicity in work that moves the robotized technologies from experts for usual people.

It became possible, not to endow flexibility and reliability, and to work even with the increase of these parameters. Automation in close places where access by means of welding robots didn’t go right till now, now became possible with a compact and mobile robots «Inrotech». The robot completed with the welding device, the block of management and cables moves on a simple monorail through hatches. There are no more sick knees, back traumas and a welding smoke in lungs. The robot takes all pain up and all bad working conditions for operators now concerned to the past. Seldom robots were more salutary among welders [4].

The expectation of a recoupment within one year meant that OSS, without fluctuating, invested in the project of automation with mobile welding robots though necessary indirect investments of the manufacture have made almost half of the budget.

Profitability improvement from Inrotech has given the Mobile robotized decision even more than it was supposed. Besides the reduction of time of welding, there was a considerable improvement of internal logistics and a production cycle. Because of the innovative decision, it was possible for OSS to automate problems which were impossible earlier. Labor-consuming welding problems are made faster now, it is better and with smaller quantity of direct labors, than earlier [7].

The bulk ship Blocks of ballast tanks which represent a double bottom of the bulk ship, in the size about 32 x 16 m., and consist of 48 closed premises in which there is an access only through hatches in the size of 60x80. Robotics systems get through these hatches, weld 90% from total number of welding works. Robots turn from the platforms located on the end of each block of a vessel [1].

Today welding robots and ceramic welding are intensively used not only in shipbuilding industry; also it’s very effective in car-building, tank-building and other branches of industry. They are properly new, economically effective. Robotic technology meets quality, cost and delivery requirements and also offers flexibility in welding. Potential safety hazards associated with arc welding include arc radiation, air contamination, electrical shock, fire and explosion, compressed gases, and other hazards. Robots can replace humans in the performance of dangerous jobs and are considered beneficial for preventing industrial accidents. The welding robot is one of the most difficult mechanisms. There’s a row of companies manufacturing welding robots, for example Austrian IPSHandelsGmbH, Japanese FANUC CORPORATION, Kemppi, ESAB, LincolnElectric, ITS-engineering, etc.

References: