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Mechanization of Production Process in Shipbuilding: A Review

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Abstract: This study provides day to day operations and recommendations to ensure that the shipbuilding industry can meet pursue new technologies and processes to reduce life-cycle and disposal cost while minimizing environmental impact. After electrification when most small machinery was no longer hand powered, mechanization was synonymous with motorized machines. As specialized occupation that traces its roots with motorized machines and different phases.

Key words: Shipbuilding, mechanization, robotics, testing methods, synonymous, motorized machines

INTRODUCTION

Shipbuilding process and building mechanization: Shipbuilding processes, includes design and planning activities (Fig. 1).

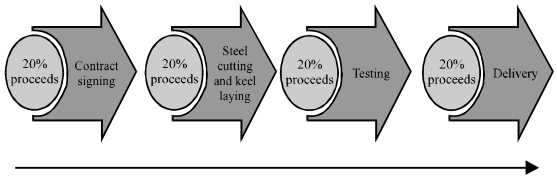

Fig. 1: Shipbuilding process flow

Building mechanization: It involves with automation and mechanization of production, integration of the shipbuilding processes, heavy robotics and handling, novel cutting and welding technologies, component and system modularization and Influence of novel vessel designs to shipbuilding (Guide and Wassenhove, 2001). And few of the effective technologies used in building mechanization and robotic handling.

Cutting by CNC machines: Accuracy, faster cutting, better edge preparation, reduce heat. The PCL machine came to make provided with an incorporated edge softening framework. Those NC cutting files are utilized for shape distinguishment beside would utilized also robot ways for adjusting the edges on go along with protection norms (Hayman *et al*., 2000). That innovation organization from claiming edge breaking is formed together with Fraunhofer Institute and clinched alongside close participation for heading adrift European shipyards.

Low cost cutting tools: Automated gas cutting, beveling machines, NOT expensive compared to the saving in time and reworks cutting fluids have been used in machining processes for many years to increase lubricity by decreasing the cutting temperature and thereby increasing tool life and part quality. These fluids are environmentally unfriendly, potentially toxic and costly to manage. In recent years, the high-volume machining industry has moved toward dry cutting to reduce or eliminate the use of cutting fluids. The dry-cutting option is not feasible for relatively small shop sites where the capital for new machines is not available.

CO_2 welding: Easier welding, better quality, faster, clean work area, slag removal is easier. CO_2 welding will be a welding transform that employments carbon dioxide on protect the weld pool starting with oxidization throughout those welding methodology. It is otherwise called Metal Inactive Gas (MIG), Manual circular segment Gas Shielded (MAGS), welding. CO_2 will be not the best gas used it needs with be heavier over air with worth of effort. CO_2 welding utilization an long loop about filler wire that is nourished done through those handheld torch this filler wire melts likewise it completes those electrical circuit by method for an electric bend which achieves temperature from claiming around 3100°C, also unsurprisingly this melts the metal.

MATERIALS AND METHODS

Accuracy control using 3 D laser scanning: Shipbuilding is one of the most complex and demanding of the manufacturing industries, combining aspects of both direct product manufacturing and capital project development (Thierry *et al*., 1995). Moreover, shipbuilders often face huge monetary penalties amounting to hundreds of thousands of dollars per day for being off

schedule. 3D laser scanning is a cost effective, accurate and fast method to help shipbuilders and manufacturers in designing, redesigning, modifying and salvaging ships. However, only a handful of several progressive shipyards (i.e., Meyer Wert GmbH, Signal International and Babcock International) use laser scanning technology because it is not currently widely adopted by the shipbuilding industry. Meyer Werft GmbH, a shipbuilder from Papenburg, Northern Germany, uses laser scanners to assist in building cruise liners, tankers and ferries. New ships are constructed from over 60 individual sections called blocks, weighing up to 800 tons each. Precise connection interfaces are critical in ship construction and block assembly mistakes cannot be made, so, consistent and accurate measurements are crucial. At every stage of new ship production, a surveying team using laser scanning technology provides services (Jayarakashvel *et al*., 2014). With more ship parts being prefabricated and then attached to the ship in one piece, 3D surveys such as taking the measurements of a sun shade composed of multiple concave shapes or a 260 m long water slide with curves and loops are critical. Signal international, a shipbuilder with multiple facilities in the US Gulf Coast, uses a laser scanner on as-built models to check both new productions as well as to generate CAD Models for refit projects. It uses the technology to assist in the creation of:

- Accurate bill of materials
- General arrangements
- Pipe arrangements
- Pipe ISO's by system
- Pipe spool drawings
- Equipment details
- Structural arrangement

Pipe fabrication: Pipe bending machine, stub penetration cutting machine, pipe welding roller, pipe cutting machine, pipe beveling machine, polypropylene coating.

Pipe bending machine: Channel bowing machines would normally mankind's powered, pneumatic powered. Water powered assisted or electric servo engine. In the channel bowing operation those (Thomas, 2007), tube might a chance to be upheld internally alternately remotely with preserve the cross area of those channel. In operations the place there is adaptability fit as a fiddle of the pipe. The channel doesn't require with be supported, however, there will be a portion deformity. In the both the cross area of the generally speaking channel and the divider thickness to separate zones of the twist.

Stub penetration cutting machine: High-penetration drill combines substrate, geometry what's more AM300 covering on expansion infiltration rates, furthermore, apparatus term. Inserts need aid accessible previously, four geometries: standard, Austenitic Stainless steel (AS), Cast Iron (CI) and Low Rake (LR). The holders would advertised for a barrel shaped shank or standard-flange even shank. Diameters reach from 11 with 35 mm what's more drill-to profundity lengths of stub, 3, 5 and 7 would accessible. Those inserts use those current GEN3SYS holders thereabouts no new tooling is needed.

Pipe welding roller: Turning moves likewise they need aid now and then called would functional adornments clinched alongside welding creation workshops, outlined to keep in spot, furthermore, with turn overwhelming barrel shaped parts around an level axis, toward an consistent and enduring turning pace in front of a welding mind (UNCTAD., 2012). On the other hand they might be turned done steps until An required position may be reached, et cetera bolted set up for settling on An longitudinal weld for a welding mind mounted looking into an voyaging carriage. Turning moves tolerance to perform boundary welds in a verthandi plane. They would likewise utilize to surfacing (cladding) or depositing toward welding a filler metal about of service properties on the outer or on the inner surface of a empty barrel.

Pipe cutting machine: Channel cutting, alternately channel profiling, may be an automated mechanical methodology that removes material from channel or tube will make an fancied profile. Ordinary profiles incorporate straight cuts, mitres, saddles what's more midsection gaps. These complex cuts are generally needed on permit a tight fit between two parts that need aid on be joined by means of circular segment welding.

Pipe beveling machine:

- Channel limits (4-24″)
- Extra chain joins might make bought to bigger channel sizes
- Cutting light race also, three tips included. Control valves to fuel gas, preheat furthermore cutting oxygen included. Manual drive (brass worm gears give acceptable smooth birch movement
- A helpful grasp permits fast revolution of the machine around those channels should confirm position and square up the chain
- Light race holder racks in, out, up furthermore down. Light race holder could a chance to be positioned in any point

Polypropylene coating: 3LPP is comparative with 3LPE covering system, the contrast may be as opposed to utilizing polyethylene concerning illustration an external layer, 3LPP utilization polypropylene tape. 3LPP may be give for moved forward effect and abrasion safety contrasted with 3LPE also may be suitableness with operation temperatures from claiming a greater amount after that 110°C. 3LPP comprising of a internal layer of combination fortified epoxy, copolymer cement layer also external layer of polyethylene. Internal layer furnish erosion insurance and adaptability same time external layer of polyethylene provide sway what's more abrasion insurance. The middle of those internal what's more external layers are tape.

RESULTS AND DISCUSSION

Robotics

Industrial robots: According to ISO 8373, a manipulating industrial robot is an automatically controlled, re-programmable, multipurpose manipulator, programmable in 3 or more axes which may be either fixed in place or mobile for use in industrial automation applications.

Industrial manipulating robots are classified by industrial branches: According to International Standard Industrial Classification (ISIC), rev. 3, some 24 industrial branches are specified. Among them there is no specific entry for shipbuilding or maritime industry. Shipbuilding robots could be classified under one of the following categories: manufacture of other metal products, except machinery and equipment or manufacture of other transport equipment.

Application areas: About 24 main areas (IFR classification). Among the of special interest for the current report are:

- Welding further broken down in arc, spot, gas, laser welding
- Special processes, further broken down in laser and water jet cutting
- Assembling, further broken down in mechanical attachment, inserting/mounting/cutting, bonding, soldering, handling for assembly operations

Type of robot: The classification is done by:

Number of axes (3, 4, 5 or more)

Type of control: Sequence-controlled/playback point to point: binary operation (i.e., start/stop) no programmed control of the trajectory in between; trajectory operated/continuous playback: 3 or more controlled axis motions specifying a time based trajectory; adaptive: Robots provided with sensory 1, adaptive 2 or learning 3 control; tele-operated.

Mechanical structure: Cartesian and gantry; SCARA: robot with 2 parallel rotary joints to provide compliance in a plane; Articulated: robot with at least 3 articulated joints; Parallel: robot with concurrent prismatic or rotary joints; Spherical and cylindrical.

Service robots: According to the above definition, some manipulating industrial robots, when operating in non-manufacturing environments could be classified as "service robots". Several robots, operating in a manufacturing environment but in non-repetitive operations and possessing some degree of autonomy cannot be classified either as manipulating industrial robots or as service robots. Service robot is a robot which operates semi or fully autonomously to perform services useful to the wellbeing of humans and equipment, excluding manufacturing operations. Often but not always, service robots are mobile.

Testing methods: Testing methods can be separated into non-destructive testing and to destructive testing methods.

Non-destructive testing: The most common way of NDT is Visual Testing (VT). Human eye can detect line shaped imperfection about 0.05 mm in width and circular imperfection about 0.10 mm in diameter. Optical instruments such as magnifying glasses and macro scopes can be used. Even though the method is simple to use, rules, guide books, contrasting items and clear limits for approval are needed to make this method reliable. Some of the NDT testing are as.

Liquid penetrant testing is a surface testing method, used to detect discontinuities in the surface of non-porous materials. It is suitable also for non-magnetic materials. Magnetic particle testing is also a surface testing method, used to reveal discontinuities in or in the immediate vicinity of the surface of ferromagnetic materials. Radiographic testing covers all the photographic methods using ionizing radiation and it can be used to reveal many kind of internal flaws. Ultrasonic testing is a method which utilizes high frequency sound waves usually between 0.5 and 20 MHz range. The sound waves travel through the material and their intensity is measured after reflection. The presence and location of the flaw can be determined from the reflection.

Destructive testing: Hardness test provides information about the metallurgical changes caused by welding. Three different commonly used hardness tests are the Brinell, Rockwell and Vickers.

The Brinell test uses a steel ball of known diameter as identer which is forced into material by specified force. The diameter of the impression is then measured and converted to Brinell hardness number, so, the hardness value is calculated as a load per area. Vickers test is similar but uses smaller inverted pyramid as identer which is ideal for measuring different zones of microstructure. The rockwell test measures hardness through depth of penetration which the identer causes on set force. The hardness indentations can be done at regular intervals or as single indentations. Impact test measures the impact strength of a test piece. The test shall be carried out in specified temperature because the impact values of metallic materials can vary with temperature. The most common impact test method is the Charpy V-notch impact test.

CONCLUSION

Planning, scheduling and controlling design/ engineering activities for the project organizational structure should be designed to fit the project's needs and has to be recognized. So, the preliminary finding of this study is that there is a need for a better way for planning, scheduling and controlling design and engineering activities in order to pursue new technologies and processes to reduce life-cycle and disposal cost while minimizing environmental impact. It should be noted that before we can be conclusive about this finding, we must properly review the field of systems engineering although, preliminary findings also has little to offer with respect to this research.

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