



PRODUCTION MANAGEMENT SYSTEMS IMPLICATIONS IN SHIPBUILDING

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Abstract: *Implication of modern management systems in the objective of the paper is to explain ship-building problems and offer a simple model of the production management in shipyards with an uneven production. Shipyards with flexible and different building programs frequently meet disturbances in their production caused by changes are due to owner's demands, overloading of capacity, and many other reasons. Such shipyards are constrained to consider it as their normal way to building ships. In order to stay competitive they have to organize their work-preparing process with integrated production engineering activities and an effective coordination of all participants in the building process.*

Key words: *integrated production engineering, computer aided design, computer aided manufacturing, computer aided engineering, work-preparing activities.*

1. INTRODUCTION

In present development IT led, mainly to a global and interactively approach way regarding some various problems solution from different fields of human activity, making available a new powerful operator, which is information technology.

In naval industry, information technology has some characteristic features resulted from this field specific feature whose final products are very complex, with a long production cycle, which imposes many cooperation activities.

2. INFORMATION

Therefore, the complex activity of shipyards, the great number of participations to the shipbuilding, the internal and external environment, extremely complicated and dynamic, had determined the shipyards to adopt profitable and flexible informatics management systems.

The lack of effective management systems lead to an incompetent and inexperienced or disorganized management, which has as a result material and production process flows are not effectively coordinated. However, tools, equipment and material (raw material and material in process) are not delivered just in time to locations where they are required. The same applies to personnel. Similarly, facilities are not ready when and where required.

The present management of shipyards has to find solutions to a serious number of problems for which it is absolutely necessary to administrate all available resources. This process must be realized by coordination within a system in which all elements (people, things, concepts etc.) to be connected to each other in order to achieve this common goal.

This means that all necessary information to be stored in a certain way making possible their fast processing, which implicates the necessity of calculus technique or, more precisely, of calculus electronic system.

Making a general execution program for a new type of ship, as well as the achievement of this process supposes a complex integrated informatics system, which operates with so called Product Informatic Pattern.

The integrated informatics system concept for research-design-production-management is based on the ship description and storage as a tridimensional model called Product Informatic Pattern, in a database, having attached all functional, technical and administrative features so that any design and/or report with information concerning material, weights, and technological information can be find in this model.

All the activities beginning with the concept, going on with the design, technological and executive operations, as well as production management are realized by a modules system, which operates interconnected in real time.

Every product – ship will have a single Product Informatic Pattern, which includes (contains) information about the whole project. This information has all technical data of the product and they represent the base of the preliminary design and production process.

The access for the users, which are taking part of the design-production process of the ship (managers, marketing compartments, design, planning, production, delivery) to the Product Informatic Pattern, is direct, fast, within the authorized competences limits and the changes that must be realized are made faster, in order to provide the permanent up-to-dating of the system information.

Informatic system allows the integration of the ship building process beginning with supply stage and ending with delivery final product stage, which is the ship, being also capable of producing all the necessary information for projection activity, production and management, becoming this way an important professional instrument for naval industry activity development [3].

Trying to remain competitive, many Romanian shipyards had introduced in the shipbuilding process proper informatic CAD/CAM/CAE systems and, to some extent, CIM (Computer Integrated Manufacturing System) with a reliable and unique database as tools in ship designing,

cost-calculations, in the creation of workshop drawing and documents for material procurement, as well as for production management and logistics purpose [4]. Therefore, the shipyards had to change their basic building strategy, production flows and to some extent even production facilities. In modern shipyards we meet fewer numbers of ships and a smaller quantity of material in production simultaneously. Production management in flexible shipyards has to play more than ever a big role in cutting building time and production costs.

2.1. Some production demands

Effective production management assumes good coordination among all participants in the shipyard’s work preparation and production. Besides, it involves effective coordination between the shipyard and its subcontractors.

Participants in the production process include the yard’s own workshop and many outside partners dealing as manufactures of different ship components as well as specialized services in ship assembly, outfitting and ship finalization work. Coordination among all interior and exterior participants could be executed only by a unique system of planning and production control.

But shipyard management doing it basically does not interfere with any subcontractor’s production process. The shipyard has to control only its capability for in-time starting of the work by controlling its logistic points as well as the end of the contracted work by controlling its delivery and other results executed by subcontractors inside or outside the shipyard.

It essential for effective production management to be able to assure simple logistics in all production phases, i.e., in hull parts fabrication, unit and block assembly, hull erection, outfitting work, surface protection and finalization work as well as activities in quality control regardless of whether they are executed in the yard’s own workshop or by subcontractors of any kind.

By controlling logistics the shipyard ought management system generally to be able to coordinate in detail the production in their own workshop and workstations and all subcontractors activities o necessary.

The nature of logistics in shipbuilding can vary considerably. In the work-preparing process can be serious problems in collecting and distributing information and documents necessary for successive work steps. Because of the importance of work preparation for the whole new project, these problems are pushed into the front row of management attention.

However, the biggest problem of logistics may be found in the production process. Each particular operation in manufacturing outfit items is supplied by material and intern products from warehouse as well as from beforehand operations just-in-time, and in the shortest possible way. It can only image how huge and complicated the management system would be needed for the manufacturing area in the whole shipyard. So the production strategy especially for flexible shipyards ought to be in decreasing the problem, dividing the management and logistics among outside partners if possible.

In many cases the flexible production programs are not serious obstacles to improving some essential production flows repetitively, for instance:

- Introducing assembly lines for flat and curved panels in manufacturing the ship hull;
- Integrating and organizing in the same production line: steel preparation, hull parts production and assembly of units and blocks;
- Introducing the early outfitting of hull structures on assembly lines;
- Overall integration on the hull production with the outfitting and surface protection works.

In any cases, it is necessary to obtain economy in production lines.

In shipyards with an emphasized flexible production program the management system has to be designed to respect big differences in final products. The basic line organization of the shipyard has to be good enough to allow simple and efficient decision-making procedures with a clean flow of information between management and all participants in the building process.

At the same time all feedback information gathered from shops has to be selected for prompt intervention against possible disturbances or obstructions in production flows.

Fig. 1 illustrates the decision-making principle in management. The decision procedure performs at several levels with the appropriate selection of information:

1. Level shipyard’s Managing Board, Business policy and shipyard strategy;

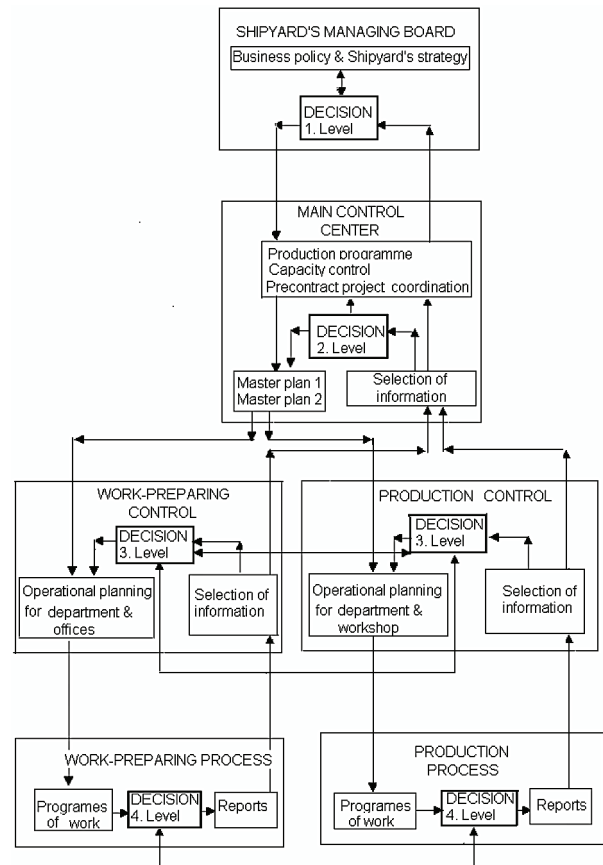


Fig. 1. Decision making principle in shipbuilding process.

2. Level Main Control Center; production program and capacity control, pre-control project coordination, master plan 1, work-preparing activities, master plan 2, production activities;

3. Level work-preparation Control + Production Control: operational planning for departments, offices and workshop, program of work;

4. Level Workshop (departments, main workshops, offices), report.

2.2. Work preparation

The production management is based on information and documents coming from the work-preparation process.

This process begins with initial, basic designing documentation from the early pre-contract phase of building a new ship, followed by functional, transition, workshop drawing and documents directed to the shipyard's production technology and ends with the ship delivery documentation.

All these documents from the earliest to the last usually respect the shipyard's building strategy, its available facilities and the work specialization which is introduced in the production.

The efficiency of the production management depends to a great extent upon the right definition of the content and volume of technical and commercial documents as well as on their quality and right-time delivery to the production process. Flows of main documents in work preparation are illustrated by Fig. 2.

Work preparing is a step-by-step process which has to be well coordinated in selling, designing, construction, purchasing and other departments of the shipyard.

- all these activities are mainly time overlapped and could be divided into several phases:
- the first phase in work preparation for a new ship is working out the basic ship design and build strategy. This consists of sets of different documents where main technical, commercial and production engineering problems of a new ship have to be solved;

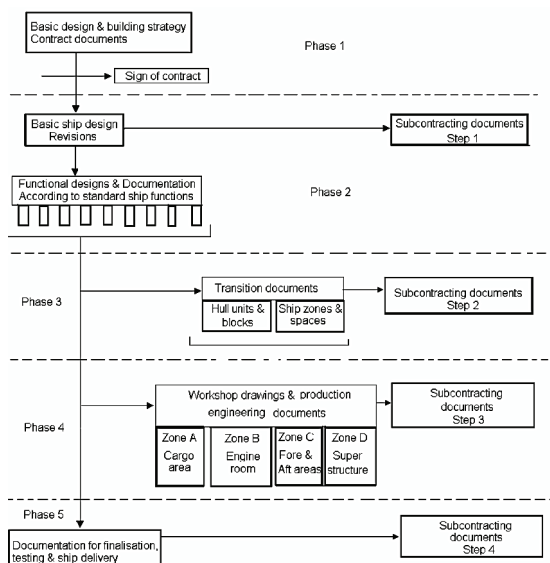


Fig. 2. Phases and flows of main documents in work-preparation process.

- in the second phase of work preparation it include all documents necessary for definition of each particular ship function and for specification of all main parts of these, i.e., steel, machinery, appliances and bigger outfit items necessary for the material procurement
- in the third phase it identity as transition documents impossible subcontracting the production of hull and outfit blocks. In this phase the final specification of all necessary material usually have to be completed
- the fourth phase in this process is workshop drawings with associated production engineering documents necessary for own workshop / workstations as well as for subcontractors if they need them.
- the last phase of work preparation is documents for the finalization, ship testing, trial and ship delivery.

Most of these documents are usually completed in the shipyard, but some are very peculiar where specialized subcontractors prefer to use their own documentation.

2.3. Structure of the management system

The database in the management system supports the shipyard's long-term planning, coordination of all main activities in the pre-contract period of the ship, coordination of work preparing activities, and coordination in production of own workshop and subcontractors with the control of relevant capacities [1]. In the other words respecting the shipyard's production program and building strategy, it has to assure the necessary coordination among all participants.

It has to emphasize the crucial importance of the information system and the reliable database for the control of important activities and production events during the building period as well as the building process analysis after ship delivery. The cost control system has to be designed for use as a base for future production cost estimates.

Taking into account the main scope of the system as well as the basic work-preparing technology, it is illustrate the structure and main elements of the management system in Fig. 3.

Excluding the long-term planning important for the shipyard's production strategy, planning activities in the management system could be divided in two main parts :

- general coordination – coordination among participants;
- operational planning – coordination of activities of a participant.

Fig. 3 illustrates the basic structure of the system, including the main documents of production strategy, general coordination, and operational planning in work preparation and production areas of assembly, outfitting and finalization.

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- general coordination – coordination among participants
- operational planning – coordination of activities of a participant

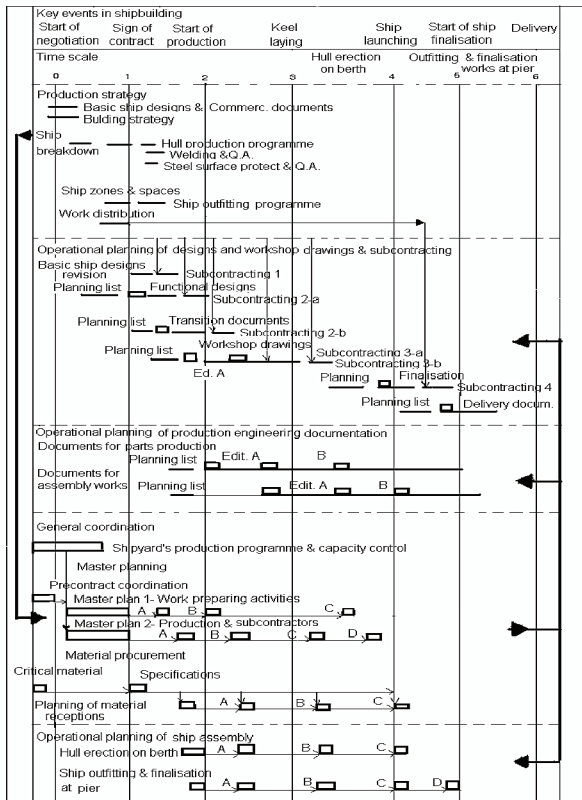


Fig. 3. Basic Structure of Shipyard’s production management.

The basic document in the general coordination is usually the production program of the shipyard connected with the capacity control and operational planning in work preparation and production areas of assembly, outfitting and finalization.

It has to be reconsidered and renewed for each new ship early in the pre-contract period, according to the ship characteristics coming from the basic ship design and the shipyard’s building strategy coordination of participants and capacity control can be carried out very roughly by foreseeing rough time periods for participants at the ship production time scale.

After definition of more detailed designs and some production engineering documents, the more precise planning can be done by master plans where main work-preparation and main production activities are coordinated. The coordination usually begins with timing of hull block assembly and berth erection work on the building time scale – the basis for all other planning in parts production – material delivery, as well as the planning of activities in the work-preparation process.

Operational planning relates to each separate participants in work-preparing and production and sometimes to subcontractors. In these cases different planning techniques could be used, mostly networks on Gantt applications, but inside time reservation from a relevant master

plan. At the same time control points of main production events coming from general coordination have to be respected.

The ship production time scale is usually divided by several key events characteristic of building periods, so it can identifies terms when each documents has to be issued and acted upon.

In building sophisticated ships the key events – negotiation starting point, contract signing, start of production, keel laying, launching / floating-out, finalization starting point and ship delivery – could be used as some kind of control points terms for revisions of plans. Because of disturbances appearing very often in work preparation and production as well as in the delivery of material / components, or sometimes because of possible disturbances in financing, plans have to be renewed from time to time.

However, the dominant reason for revision in the shipyard’s system of work preparation, which is sometimes a very successive definition of the new project overlapped with the period of ship production.

3. CONCLUSION

An effective and simple management system in every shipyard could dramatically shorten production cycles, increase productivity, and cut production costs [2].

A well designed management system with appropriate logistics should coordinate and control the whole building process. It has to allow participants to have effective influence in order to prevent disturbances appearing due to the complexity of the final product and the short production time. Modern information systems and effective techniques of direct alarm notifications with requests for specific action to managers, supervisors, and foremen are in use now. In several modern shipyards from Romania it can see the first appearances of CIM system covering the area of production management.

REFERENCES

- [1] Heane, R. G., Fireman, H., Jr. (1993). *Productibility in the Naval Ship Design Process: A Progress Report*, vol. 9, No. 4.
- [2] Beaver, K. (2000). *Enterprise Systems Integration: opportunities and obstacles developing plant asset management systems*, National Manufacturing Work, Chicago, IL.
- [3] Lattore, R, Zeidwen, L. (1994). *Computer – Integrated Manufacturing a Perspective*, Journal of Ship Production, vol. 10, no. 2.
- [4] Varesko, R., Vitasovic, E., Milanovic, M. (1994). *The Development of the CAD/CAM System in Vljanik Shipyard*, Brodogradnja, vol. 42, no. 4, Zagreb.

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