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Description of the Processes Concerning the Shipyard (Repair Phase)

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1 Description of the Shiprepair Processes

1.1 Introduction

The analysis of processes concerning the repair phase of the basic emergency repair scenario (see specification in document No 1-00-W-1999-01-x) was achieved using the information provided by the experts of Neorio and Lisnave.

The repair phase comprises the time period from the Invitation to Tender until the docking of the vessel into the shipyard.

1.2 Description of current processes

This section includes a brief description of the overall operation of a shiprepair yard, from the initial enquiry of the customer to negotiation, to shiprepair work, to contract completion.

Receive Shipowner enquiry:

This could come in the form of a phone call, saying that there is a damage on a ship or that the ship is on its way. This form of communication could be used for regular customers or for emergency work.

More commonly the initial enquiry comes in the form of a written description or specification, with an Invitation To Tender. The Invitations To Tender that are received vary greatly in detail, from brief descriptions such as «Fit a new engine», to perhaps 3 or 4 volumes, listing and describing each job in great detail down to the last nuts and bolts.

Is the tender desired?

The decision as to whether to tender or not is often based on previous experiences with the customer, addressing issues such as:

Do they pay their bills?

Are they awkward to work for?

Do we need the work? etc.

Is the damage repairable in the shipyard?

Will the vessel physically fit in the dock?

Is the dock available?

Can the work all be done «In house», or are sub contractors needed. If so, quotations are obtained from them. Quotations are also requested for any materials and equipment that is required for the contract.

Produce an estimate:

An estimate can be produced, based on the expected number of hours required to complete each of the jobs on the specification. The estimate will also include the quotations that will now have been received from the relevant suppliers and sub contractors. When the estimate is complete, the tender will be submitted to the owner.

Change Orders:

During the period between the first contact with the ship yard when the Invitation ToTender is received, and the time when a ship leaves the yard, having had all the work completed on her, there are virtually always many changes made to the contract. These changes are known as «Change Orders», and cover the following and more:

Emergent work.

Re-Ordering or prioritising.

New jobs added.

Old jobs cancelled.

Jobs partially cancelled

Cancelled jobs reinstated.

Ship repair jobs are often done to a fixed budget and is therefore a «Fixed Cost» exercise. This is because the owner has a certain amount of money that he is prepared to spend on maintenance and repairs. He then prioritises the jobs until that money is spent.

Is the tender accepted?

Ship owners may accept or decline a tender for many reasons, some are as follows:

Price.

Ship yards reputation for quality and service provided.

Vessels proximity to the dock at a convenient time.

Although it is virtually certain that the content of the contract will change throughout the period of the contract, owners may still make a price based decision, as a yard which quotes a lower price for most of the contract will probably remain competitive for the change orders.

Plan the work:

If the tender is won, the work for each of the jobs needs to be planned. The planning must make sure that the jobs are carried out in the correct order, as there are some jobs or activities that must be separated by time, space or both. e.g.,

Time: some jobs can not be done before others, such as the engines cylinder heads must be removed before the valves can be inspected

Space: Aluminum work and steelwork can not be done in the same area, as this could lead to contamination of the materials.

Both: Blasting must be done before painting, but the two activities cannot be done simultaneously in the same area.

The materials for the jobs must now be ordered, especially for items having a long lead-time to delivery, such as engines and some items of equipment. The sub contractors required for the contract must also be booked.

Recruit permanent & casual labour:

Depending on the size of the contract that has been won and the number of other contracts under way, there may be a need to Recruit some additional labour. Much of the workforce in the ship repair industry is employed on a casual basis, enabling the shipyards to have a work force of the size required for that particular time, and also to employ workers with the relevant skills for each contract.

Do the work:

When the ship arrives at the yard, records must be kept of all the change orders that are made. These changes may be estimated for if the owner is still deciding which of the jobs to have done and which to leave. If the change order jobs were not estimated for, they would be charged out at a certain hourly rate, or at a rate per m, m^2, kg, etc, for jobs such as wiring, painting and welding.

Produce an invoice:

All of the hours that are spent on the job must be recorded allowing the workers to book their time to the correct contract. Any other expenses from the suppliers and sub contractors must also be kept track of, as the bill will be produced for the customer long before all of the invoices have come in for the materials, equipment and sub contractors involved in that contract. The bill is usually given to the owner before the ship actually leaves the dock, depending on the relationship with the owner in question and their history of paying previous bills.

Activities that take place prior to, throughout and after the contracts.

Prior:

Prior to getting a contract, the potential customers are identified and targeted by the marketing department. This will involve meeting ship owners and other potential customers and informing them of what facilities the shipyard has to offer and the type of work that they carry out.

Throughout:

The details of all the hours worked on each job need to be recorded. This enables the wages to be calculated.

The change orders need to be recorded and dealt with and the conditions of the contract may need amending. This will be the case if the change orders increase the amount of time required to complete the jobs and contract, as there are often penalty clauses if the vessel is not completed on time.

The shipyard has to operate within environmental legislation, restricting or banning some activities which cause damage or harm through polluting the environment. This pollution may be chemical pollution, noise pollution or pollution from any other activity such as painting and blasting.

Throughout the contract tools, items of equipment and machinery may need maintenance or repairs carried out to them. The planning of this maintenance should be done to allow it to take place during quieter periods, rather than leaving it until something breaks or stops working.

After the contract is complete:

The details of the contracts, including the owners and vessels details, plus all the details of the work carried out on the vessels needs to be archived for future reference.

Historic data about the hours each employee spends on different jobs may also be of some use in future years if there are any claims made against the company for poor working conditions, repetitive strain injuries, exposure to chemicals and hazards, etc.

All of the above activities are related to each individual contract. A busy repair yard may have a dozen contracts running concurrently. This highlights the need for a fast and efficient information control system.

The process which is described previously, is also shown in the flowchart that follows.

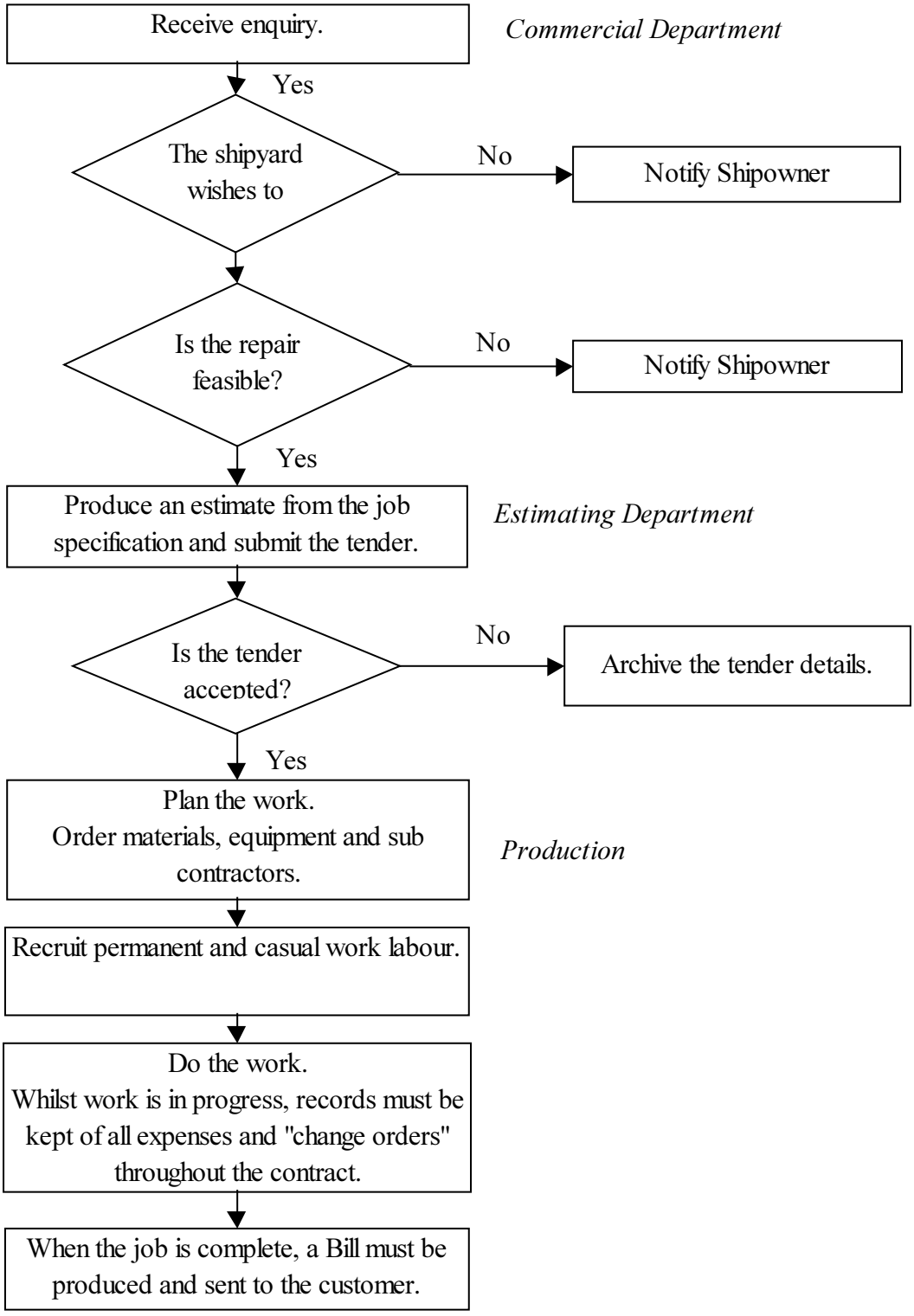

Figure 1. Shiprepair Processes

1.2.1 Strength and Weakness of current procedures

By the time the above described processes are performed simply without the usage of the electronic technology that is available. So the communication technologies with the shipowner or with external suppliers or subcontractors, that are in use by the most repair shipyards can be summarized as follows. It must be noted however, that not all repair yards use all of the following, and those which do, do not use all of these.

Fax:

Advantages:	Hard copy of the communication received.
	Cheap method of communication.
	Fast method of communication.
Disadvantages:	Quality is reasonable, but not as original.

Telephone:

The telephone can be used as a means of contact with external companies.

Advantages:	Speed of response.
	Can discuss any complications.
	Universal means of communication.
Disadvantages:	There is no record of the communication.
	Can take a time, or more than one call to speak to the relevant person.
	Time can be wasted discussing things irrelevant to the job.

Post:

Advantages:	Hard copy of the communication received.
	Can send documents, catalogues etc. in any form.
	Universal means of communication.
Disadvantages:	Slower form of communication.

Email:

The use of email is increasing throughout the ship repair industry. The following communications are now carried out in some yards with some external companies using the email system:

- The Invitation To Tender, with the owners specification.
- The submission of the tender.

When combined with a computer and modem, a computer can be used as a mobile email and communication system.

The use of email could be extended to cover further areas, such as the following:

- Sending out of enquiries to suppliers and sub contractors.
- Sending of purchase orders to suppliers.
- Distribution of job specification to sub contractors, allowing them to quote.

Advantages:	Speed of delivery.
	Hard copies can be printed off.
Disadvantages:	Messages are easily deleted.
	Not all companies have email facilities.

Personal visit:

This can be either a representative from the external company visiting the repair yard, or some one from the repair yard going to the external company to speak to them. This method is used for items that are of a high value and is usually only used after other forms of communication have been exchanged. Ship repair yards may send someone out to a supplier to collect some goods, if for example they are needed urgently and work can not progress without them.

Advantages:	Complications and queries that emerge can be discussed.
	Greater chance of getting the truth when you can “see the whites of their eyes”.
	Encourages better working relationships for both companies.
	Can be fastest way of getting goods when using local suppliers.
Disadvantages:	Costs more in time and expenses to visit external companies.

2 Specification of data requirements[1]

The data required for the preparation of the tender and its submission to the owner are grouped in entities. The entities are outlined below.

- Tenders
- Estimates
- Contracts
- Ships
- Customers
- Employees
- Time keeping
- Purchase Orders
- Item details
- Hire items
- Subcontractors

2.1 Identification of Data Requirements

The following set of attributes is required for each one of the Entities identified so far.

Tenders
Id of the enquiry received by the customer.
The id of the tender
The id of the customer who submitted the enquiry.
The id of the related ship.
The id of the corresponding estimate.
The date the invitation to tender arrived.
The date the tender was submitted
The name of the estimator that will produce the estimate for the ship.
The quoted price for the repairs in the ship.
The number of the days expected to fulfil the repairs to the ship.
The days the ship was docked refereed in the quota.
The estimation of the materials needed for the repairs.
The estimation of the subcontracts costs needed for the repairs.

[1] The data presented concern the specified scenario.

Estimates
The estimate’s identification number
The related enquiry’s id
The customer's id
The ship's id
The name of the responsible estimator
The estimated total price for the repairs.
The estimated man-hours for the repairs.
The estimated man hours' cost
The estimated materials' costs.
The estimated subcontracts' costs.
The estimated date for the ship's arrival.
The estimated date for the ship's departure.
The id of the list of jobs for the estimate

Contracts
The contract's identification number
The related enquiry’s id
The customer's id
The ship's id
The date the contract has been activated
The name of the contract's manager defined by the shipyard.
The estimation total price for the contract.
The estimated man-hours for the contract.
The estimation for the purchased materials costs for the contract.
The estimation for the subcontracts costs done for the contract.
The estimated date for the ship's arrival.
The estimated date for the ship's departure.

Ships
The id of the related customer.
The identification of the ship.
The name of the ship.
The ship type.
The length of the ship.
The ship's breadth.
The dock(s) that can take the ship

Customers

Customers
Customer's identification number.
Customer's name.
Customer's address.
The customer's postcode.
The customer's country.
Customer's phone number.
Customer's fax number.
The name of the contact person in the customer's office
The date the customer was visited.
Notes about the customer.
The date of the next visit to the customer.
The name of the agent who contacted the customer.

Planning entities

Shipyard
The description of the factory

Job_Shops
The id of the respective factory.
The id of the job shop
The job shop name
The id of the job that is being processed by the job shop

Work_Centers used to represent the work_centers in each job_shop
The id of the respective job_shop.
The id of the work_center.
Description of the workcenter's type.

Work_Orders
Work Order Id
Job Id
The id of the factory which is assigned.
The name of the foreman responsible for the completion of the order
The earliest time the production of the order can start.
The actual start time of the order
The due date of the order.
This attribute gives information on the progress of the work order

Jobs
The identification number of every job.
The description of each job's status.
The subcontract's status.
The id of the related contract.
The number of the changed orders for this job.
The description of the job.
The date when the job was entered.
Notes about the job.
The date the job was printed out.
The estimated man-hours for the fulfilment of this job.
The estimated labour cost for this job.
The estimation of the items for the job, which will be purchased.
The estimation of the subcontracttracts needed for the job.
The price in the quotation for this job.
The estimated date the job will be completed.
The man-hours spend for the job.
The overtime man hours spent for the job.
The labour cost for the job.
The premium paid for this job.
Items purchased for the job.

Jobs
The subcontract for the job.
The percent of the job that is completed.
The date the job was updated.
The description of the modification for this job.
The allowances for this job.

Job_Order is the entity we use to represent the set of orders assigned to a job shop
The id of the product order.
The id of the respective job.
The id of the related job_shop
The due date of the job ordered.
Active task order. This attribute is used for the identification of currently processed task order within a job order.
Status. This attribute is used for providing scheduling information. It's values are "pending" ,"assigned" and "finished".

Job_Task is the entity we use to associate the entities JOB and TASK. The attributes of this entity give her the power to represent sequential, parallel, and alternative structures of tasks.
The id of the respective task of the Job.
The terminal task in completing a job.

Task_Order represents the orders assigned to a workcenter.
The id of the respective task.
The id of the related job_order.
The id of the related workcenter.
The number of orders assigned to the workcenter.
The amount of time a task order was in pending status.
The amount of time a task order was in queue.
The cost of the respective task order.
The due date for the current task order.
The current status of the task order. For example "pending" ,"assigned" or "finished".

Criterion_Statement is used for providing methods to be used for calculation of the actual values of decision criteria by applying a procedure to a set of parameters.
Criterion id
The type of the respective task.
This field contains the appropriate procedure.

Task defines the instructions necessary to conduct a task order
Task id
The type of the task.
Description of the task.

Suitable Resource is to associate tasks with resources capable of performing them, in addition it provides the optimal processing parameters for each task resource combination.
Resource id.
The id of the related task.
The name of the processing parameter.
The value of the processing parameter.

Assignment is used to represent assignments of task_orders to resources.
The id of the respective task order is also part of the primary key for this entity.
The id of the related resource is the other part of the primary key.
The time the assignment is expected to start.
The time the assignment is expected to end.
The current status of the assignment.

Resource is the entity used to describe the machines
Resource id
Description of the referred resource
The estimated time the resource will be available.
The current status of the resource.

Equipment_ Resource is also a subtype of the RESOURCE entity. It's used for describing the equipment characteristics
Resource id.
The type of the equipment.
The rate of the equipment.
The amount of time the equipment is in idle status
The amount of time the equipment is busy.
The amount of time the equipment is down.

Tool_Resource is another subtype entity of the RESOURCE entity and it's used to describe the characteristics of the available tools.
Resource id.

Activity is the entity, which is used to define elementary instructions that are contained in tasks.
Activity id
The type of the activity.
The description of the activity.

Criterion entity is used for denoting the set of potential planning criteria
Criterion id.
Represents the default value of a criterion, which is used from the Aggregation Function.
The function which is used for calculating the value of a criterion for an alternative.

3 Requirements for future processes (web based integration tool)

From the point of view of the shipyard, the following aspects should be considered:

The specific data of the ship, such as damages and/ or required work list, should be available in electronic form, so that the data transmission process should be automated and speed up.

In addition the software from the point of view of the shipyard should have the functionality of translating the existing data from the existing format to the format that is required by the Integration tool.

Furthemore additional data or information such as drawings or pictures should be available electronically, so that the process can be executed in a faster mode.

Finally, it is important for the shipyard to be able to deliver the estimate about cost of the repair and the schedule for it in electronic format, so that the time for the completion processes can be limited.

