The Analysis of a Sea Vessels Costing System

by

Mr. Kirk Vilaimal

A Final Report of the Three-Credit Course
CE 6998 Project

Submitted in Partial Fulfillment
of the Requirements for the Degree of
Master of Science
in Computer and Engineering Management
Assumption University

November 2003
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Project Title: The Analysis of a Sea Vessels Costing System
Name: Mr. Kirk Vilaimal
Project Advisor: Dr. Chamnong Junghirapanich
Academic Year: November 2003

The Graduate School of Assumption University has approved this final report of the three-credit course, CE 6998 PROJECT, submitted in partial fulfillment of the requirements for the degree of Master of Science in Computer and Engineering Management.

Approval Committee:

[Signatures and titles]

November 2003
ABSTRACT

This system development project focuses on developing a computerized information system to support a decision of Business Development Division on The Analysis of Sea Vessels Costing System (ASVCS) including information on costing, equipment, suppliers, operating expenses, capital budget spending, and BD special activities (programs).

The main function of the Business Development Division is to manage the budget and generate report to Top Level Management on decisions in important investment and have sea vessels to serve and satisfy the customers.

The study for the project started by finding all the processes related to BD transactions, database management, budget control, and all costing on sea vessels paid for standard and maintenance and focused on the areas where improvement could be made by solving the existing problems or constraints. Analysis tools such as data flow diagrams, process specifications, and data dictionaries are the main techniques for developing the environmental and behavioral model. Furthermore, consolidating the database in one program is useful for assisting planners in improving the strategic decision-making.

Since the existing system is mainly manual and has no integration among the Analysis of a Sea Vessels Costing System (ASVCS), Business Development Division and problems happen in other Departments e.g. Crew Department, Ship Operation Department etc. in many cases. For instance, there are problems of redundant processes, slow working processes, data entry, and the high cost of managing data.
ACKNOWLEDGEMENTS

The writer is indebted to the following people. Without them, this project would not have been possible.

The writer wishes to express his sincere gratitude to his advisor, Dr. Chamnong Junghirapanich. The advisor's patient assistance, guidance, and constant encouragement have led the writer from the report inception to the report completion.

He would like to thank Mrs. Kanyanut Rasamee who made him understand the details of analysis of sea vessel's costing system and help in gathering information for use in this projects.

Special appreciation is due to his family and his friends for their fervent and continuous encouragement. They always exert a strong willpower for him to successfully complete this project.

Lastly the writer thanks his special person who has shown him for all kindness, patience and understanding during his times of need. He will always keep the memories of this time forever.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABSTRACT</td>
<td></td>
</tr>
<tr>
<td>ACKNOWLEDGEMENTS</td>
<td>II</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>V</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>VII</td>
</tr>
<tr>
<td><strong>I. INTRODUCTION AND SYSTEM OVERVIEW</strong></td>
<td></td>
</tr>
<tr>
<td>1.1 Introduction to the Project (ASVCS DBMS)</td>
<td></td>
</tr>
<tr>
<td>1.2 Company Overview</td>
<td>1</td>
</tr>
<tr>
<td>1.3 Company Main Policy</td>
<td>3</td>
</tr>
<tr>
<td>1.4 Business Development Division</td>
<td></td>
</tr>
<tr>
<td>1.5 Objectives of the Study</td>
<td>6</td>
</tr>
<tr>
<td>1.6 Necessity &amp; Benefit of the project</td>
<td>6</td>
</tr>
<tr>
<td>1.7 Scope of the Project</td>
<td>7</td>
</tr>
<tr>
<td>1.8 Project Deliverables</td>
<td>7</td>
</tr>
<tr>
<td>1.9 Project Plan</td>
<td>8</td>
</tr>
<tr>
<td><strong>II. THE EXISTING SYSTEM</strong></td>
<td></td>
</tr>
<tr>
<td>2.1 Overview of Existing Processes and Database</td>
<td>9</td>
</tr>
<tr>
<td>2.2 Current Problems and Areas for Improvement</td>
<td>38</td>
</tr>
<tr>
<td>2.3 Existing Computer System</td>
<td>40</td>
</tr>
</tbody>
</table>
Chapter III. THE PROPOSED SYSTEM AND REQUIREMENTS ANALYSIS

3.1 Overview of Proposed System 41
3.2 User Requirements 42
3.3 New Proposed System and System Design 43
3.4 System Requirement 43
3.5 Security and Control 44
3.6 Cost Benefit Analysis 46

Chapter IV. SCREEN INTERFACE DESIGN

4.1 Screen Interface Design 52
4.2 Report Design 56

Chapter V. PROJECT IMPLEMENTATION

5.1 Overview of Project Implementation 68
5.2 Implementation 69

Chapter VI. CONCLUSIONS AND RECOMMENDATIONS

6.1 Achievements and Modeling 70
6.2 Conclusions 71
6.3 Recommendation 72

APPENDIX A DATA FLOW DIAGRAM
APPENDIX B DATA DICTIONARY
APPENDIX C DETAIL OF DATA FLOW DIAGRAM

BIBLIOGRAPHY 115
<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Organization Chart</td>
<td>4</td>
</tr>
<tr>
<td>2.1</td>
<td>Panamax Tanker Picture</td>
<td>9</td>
</tr>
<tr>
<td>2.2</td>
<td>Aframax Tanker Picture</td>
<td>10</td>
</tr>
<tr>
<td>2.3</td>
<td>Suezmax Tanker Picture</td>
<td>11</td>
</tr>
<tr>
<td>2.4</td>
<td>Very Large Crude Carrier Picture</td>
<td>12</td>
</tr>
<tr>
<td>2.5</td>
<td>Ultra Large Crude Carrier Picture</td>
<td>13</td>
</tr>
<tr>
<td>2.6</td>
<td>Outline of Existing Program</td>
<td>14</td>
</tr>
<tr>
<td>3.1</td>
<td>Overview of proposed System</td>
<td>41</td>
</tr>
<tr>
<td>3.2</td>
<td>Security System</td>
<td>44</td>
</tr>
<tr>
<td>3.3</td>
<td>Cost Comparison Shown</td>
<td>51</td>
</tr>
<tr>
<td>4.1</td>
<td>ASVCS ICON</td>
<td>52</td>
</tr>
<tr>
<td>4.2</td>
<td>Accessing the System</td>
<td>53</td>
</tr>
<tr>
<td>4.3</td>
<td>The first Screen of the system</td>
<td>54</td>
</tr>
<tr>
<td>4.4</td>
<td>Cost Information Main Screen</td>
<td>54</td>
</tr>
<tr>
<td>4.5</td>
<td>Print Report Main Screen</td>
<td>55</td>
</tr>
<tr>
<td>A.1</td>
<td>Data Flow Diagram</td>
<td>75</td>
</tr>
<tr>
<td>A.2</td>
<td>Level 0</td>
<td>76</td>
</tr>
<tr>
<td>A.3</td>
<td>Level 1-1</td>
<td>77</td>
</tr>
<tr>
<td>A.4</td>
<td>Level 1-2</td>
<td>78</td>
</tr>
<tr>
<td>A.5</td>
<td>Level 1-3</td>
<td>78</td>
</tr>
<tr>
<td>A.6</td>
<td>Level 1-4</td>
<td>79</td>
</tr>
<tr>
<td>Figure</td>
<td>Level</td>
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<tr>
<td>A.7</td>
<td>Level 1-5</td>
<td>79</td>
</tr>
<tr>
<td>A.8</td>
<td>Level 1-6</td>
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</tr>
<tr>
<td>A.9</td>
<td>Level 1-7</td>
<td>80</td>
</tr>
<tr>
<td>A.10</td>
<td>Level 1-8</td>
<td>81</td>
</tr>
<tr>
<td>Table</td>
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<td>58</td>
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<td></td>
</tr>
<tr>
<td>B.1 Master</td>
<td>82</td>
<td></td>
</tr>
<tr>
<td>B.2 Import-Cost-ACC</td>
<td>82</td>
<td></td>
</tr>
<tr>
<td>B.3 Import-Cost-SOP</td>
<td>82</td>
<td></td>
</tr>
<tr>
<td>B.4 Import-Cost-ADM</td>
<td>82</td>
<td></td>
</tr>
<tr>
<td>B.5 Import-Cost-CRW</td>
<td>83</td>
<td></td>
</tr>
<tr>
<td>B.6 Import-Cost-ENG</td>
<td>83</td>
<td></td>
</tr>
<tr>
<td>B.7 Cost-Categories</td>
<td>83</td>
<td></td>
</tr>
</tbody>
</table>
I. INTRODUCTION AND SYSTEM OVERVIEW

1.1 Introduction to the project

The Analysis of a Sea Vessels Costing System (ASVCS) is a computerized database system for work, analysis, and control of a budget plan of Business Development Division.

ASVCS is created with the objective of centralizing and managing on budgeting system on a PC system. By being separate from the existing LAN system, the ASVCS can import raw data in order to computerize conveniently and more effectively. Since the current procedure separates people working on different pieces of data, it is very difficult and time-consuming to collect all the costing information. Management cannot gather data on time, thus the decision making is delayed. Concurrently, the current LAN system is a high-performance base which needs time and experienced programmers to be utilized effectively, thus creating inflexibility.

1.2 Company overview

Nathalin Co., Ltd. was founded on July 21, 1987 with a registered capital 1 million bahts on the purpose of services on carriage petroleum products by OIL TANKERS for PETROLEUM AUTHORITY OF THAILAND (PTT) and Major Oil Companies. The Company started on running business with two small tankers (1,000 deadweight ton), after that "Nathalin" has grown steadily and firmly, at present the registered capital of company is 85 million bahts together with twelve OIL TANKERS. Committed to improve vessels to a high degree of efficiency, the company emphasizes the safety operations, ships maintenance and training crewmembers in accordance with international standards including investment in the safety equipment, communication equipment and environmental protection.
equipment for company vessels to comply with the regulation of International Maritime Organization (IMO) such as The International Convention for the Safety of life at sea 1974 and Amendments (SOLAS), The International Convention for The Prevention of Pollution from ships 1973 11978 (MARPOL 73 / 78) and The International Convention for Standard of Training, Certification and Watch keeping of Seafarers 1995. (STCW 95)

In Search Of Excellence Today, Nathalin Co., Ltd. Operates 12 oil tankers, sizes of vessel are 1,000 — 45,000 deadweight tons, volume capacity about 80,000 dwt., Number of office staff 48 and Number of seafarers 168. Company's commitment is to be One of Thailand's leading petroleum — transporting company, the vessel quality is the same as the neighboring vessels in this region and intended to develop crewmembers, ship management system compliance with INTERNATIONAL SAFETY MANAGEMENT SYSTEM (ISM CODE) and INTERNATIONAL STANDARDIZATION ORGANIZATION (ISO) for the purpose of competition with foreign flag vessels, increase business operations in South East Asia and enable to minimize the nation's dependence on expensive foreign flag vessel's freight. After 15 years, the company has steadily grown respectively, from the main business of carriage of petroleum products within domestic market only to expand to International markets, from a few local shareholders to many local shareholders and many foreigner shareholders, from office staff of 7 persons to 48 persons, from being the shipowner of 2 vessels and from " NATHALIN CO., LTD." to become to "NATHALIN GROUP " which consists of 9 companies as follows:
### Consolidated Companies

<table>
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<tr>
<th>NO.</th>
<th>COMPANY NAME</th>
<th>TYPE OF BUSINESS</th>
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<tbody>
<tr>
<td>1.</td>
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<td>Shipowner and Shipmanagement</td>
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<td>2.</td>
<td>N. T. L. Marine Co., Ltd.</td>
<td>Shipowner</td>
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<td>3.</td>
<td>Khunnathee Co., Ltd.</td>
<td>Shipowner</td>
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<td>4.</td>
<td>United Tankers Co., Ltd.</td>
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<td>5.</td>
<td>Thavorn Marine Co., Ltd.</td>
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<td>6.</td>
<td>Asia Seatrans Co., Ltd.</td>
<td>Shipowner</td>
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<td>7.</td>
<td>N. S. N. Engineering &amp; Services Co., Ltd.</td>
<td>Ship spare part supplier</td>
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<td>8.</td>
<td>Sea oil Co., Ltd.</td>
<td>Oil Trading</td>
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<td>9.</td>
<td>Alliance Tankers Co., Ltd.</td>
<td>Ship's broker</td>
</tr>
</tbody>
</table>

#### 1.3 Company Main Policy

The Nathalin Co., Ltd. is committed to continually improve all levels of the organization for the services of carrying oils by ships with pertinent Quality and International Standard and customer satisfaction by maintaining the Management and providing adequate resources for efficiency with identifying working teams and disciplinary needs.

#### 1.4 Business Development Division

This division get all costing in each department of organization and evaluate data to plan and present to board of committee to approve or decide on investment of new projects for customers.
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1.5 Objectives of the Study

The objectives of developing Analysis of a Sea Vessels Costing System for Nathalin Group are as follows:

(1) To study the existing system in order to understand current working procedures.

(2) To set up a computerized system for The Analysis of a Sea Vessels Costing System.

(3) To update the data and information correctly.

(4) To arrange and generate reports correctly to other departments and Top Management.

(5) To bring new technology equipment for use in The Analysis of a Sea Vessels Costing System.

(6) To increase the security control of The Analysis of a Sea Vessels Costing System.

(7) To reduce the expense of The Analysis of a Sea Vessels Costing System.

(8) To enhance the efficiency and effectiveness of the organization.

1.6 Necessity & Benefit of the Project

ASVCS is a must for the current BD Division since Nathalin's current business is changing. It must cope with changes and in order to do that, it needs a powerful database management system to manage the database successfully. The benefits from ASVCS are summarized as follows:

(a) Centralized program for all ASVCS database.

(b) Flexible and easily-modified database for practical use.

(c) On-time periodic update of information.
(d) Interface program for all users on real-time basis.
(e) User-friendly program.

1.7 Scope of the Project

The project covers mainly the following parts of The Analysis of a Sea Vessels Costing System of Nathalin Co., Ltd.

(1) To analyze the system and design a computerized system for projected Analysis of a Sea Vessels Costing System.

(2) To analyze the hardware and software for the projected Analysis of a Sea Vessels Costing System.

(3) To analyze and design the database for The Analysis of a Sea Vessels Costing System.

(4) To describe process specifications for the new system.

(5) To design screen layouts and report layouts for users.

(6) To compare cost expense between the manual system and computerized system.

1.8 Project Deliverables

The deliverables The Analysis of a Sea Vessels Costing System.

(1) Tangible deliverables

   (a) Computerized system for The Analysis of a Sea Vessels Costing System.

   (b) Application software for The Analysis of a Sea Vessels Costing System.

   (c) Database System for The Analysis of a Sea Vessels Costing System the Analyze Vessels Costing Plan.
(d) Screen layouts and report layouts for The Analysis of Sea Vessels Costing System

(2) Intangible deliverables

(a) Efficiency and effectiveness of The Analysis of a Sea Vessels Costing System

(b) Conveniences of the staff in working process.

1.9 Project Plan

In implementing ASVCS, some required steps would be followed. Please see the following Gantt chart.

Table 1.2. Gantt Chart.

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II. THE EXISTING SYSTEM

The main business flows in ASVCS can be summarized as follows:

2.1 Overview of Existing Processes and Database

When the company received order from customer i.e. PTT., Bangchak, Caltex, Thaioil and the company doesn't have the sea vessels to serve customers. So company starts looking for new ones.

Today there are many types of oil tankers in the world. Nathalin is looking for the oil tankers the example as follows:

Panamax Tankers

Ships in the 55 - 70,000 dwt. size range. 70,000 dwt. Being the maximum size tanker able to transit the Panama Canal. The need to pass through a series of Canal locks dictates a maximum length of 274.3 metres and maximum breadth of 32.3 metres. In the Atlantic Basin trades Panamax vessels have a competitive advantage over larger tankers due to physical trading and local port depth restrictions. North American imports of crude and fuel oil comprise the bulk of Panamax tanker business.
Aframax Tankers

Tankers in the 75,000 - 120,000 dwt. Size range. AFRA is Average Freight Rate Assessment. At one time Aframax was used to refer to ships up to 79,999 dwt., the upper limit of one of six deadweight groups for which the AFRA rate is assessed. Aframax has since become a general term for ships in this overall size range. Aframax ships are traditionally employed on a wide variety of short and medium-haul crude oil trades. The biggest tanker that can be accommodated fully laden in the ports of the US — the world's largest importer of oil - is 100,000 dwt. And this only at a limited number of ports. Many of the more modern ships in the Aframax size range are built as long-haul product tankers with epoxy-coated tanks.

Figure 2.2. Aframax tankers Model.
Suezmax Tankers

Suezmax tankers are ships in the 120,000 - 200,000 dwt. size range and are generally identified as those capable of lifting one million barrel cargoes. The name was originally bestowed on such ships from 1980 when a development project which deepened on the waterway to 16.1 metres was completed. The largest tankers able to transit the Suez Canal Fully laden were those of 140,000 - 150,000 dwt. This association will effectively become redundant later this year when a project to deepened on the Canal to 18.9 metres is completed. The Canal may be further deepened to 20.1 metres by 2005 and 22.0 metres by 2010.

Figure 2.3. Suezmax tankers Model.
Very large crude carriers (VLCCs)

VLCCs are tankers in the 200,000 - 320,000 dwt. Size range. Ships of this size were prompted by the rapid growth in global oil consumption during the 1960s and in 1967, closure of the Suez Canal, necessitating voyages around the Cape of Good Hope. Today VLCCs are the most effective way of transporting large volumes of oil, including 2-million barrel cargoes, to customers over relatively long distances. Relatively simple ships. VLCCs are subdivided into a number of cargo tanks by two longitudinal and several transverse bulkheads.

Figure 2.4. Very large crude carriers (VLCCs).
Ultra large crude carriers (ULCCs)

Tankers in excess of 320,000 dwt. Most ships of this type were built in the mid to late 1970s and are now approaching 25 years of age. Ordered to take advantage of the economies of scale in a buoyant market, they were delivered as oil prices skyrocketed and demand collapsed. There are now under 40 of these ships remaining. Rather inflexible and limited to serving a few deepwater ports, ULCCs never achieved their full potential. In early 2000 a tanker owner ordered two 440,000 dwt ULCCs, with 2 options. The first ULCC order in 20 years.

Figure 2.5. Ultra large crude carriers (ULCCs).
When the Board of the company meets and agrees to purchase new sea vessels, the BD of company make the new project and feasibility plan for budget to buy sea vessels and to serve enough demand of the customer.

In the past BD division plan, the project is in simple MS-Excel and kept everything on spreadsheet.

Now we are looking for the way to find it easier than the past. In Visual Basic 6, we can code programming for new projects on different situations.

Secondly BD evaluate the costing of sea vessels on the project as follows:

Arrangement of costs

However one considers the arrangement of the departments on the ship and ashore, the relationships between them and responsibility for costs. Each of the large number of cost centres must be considered in preparing the budget. There is no reason why there should not be just one "ship budget" of many items, but as explained it is more convenient to deal with large quantities in small groups. For this reason the
Considering each department in turn and its effect upon the others:

**CREW:**

The numbers, quality and "mix" i.e. the distribution of skills within the crew, probably have more inter-departmental effect than any other as follows:

Technical: Inefficiency and negligence by the crew, particularly at the senior and skilled level, can result in accidents, breakdowns and a low level of maintenance. This ultimately increase costs as more labor has to be brought in to rectify matters, often at higher costs than the crew. Insufficient crew or the wrong "mix" will also result in work being done by shore workers and poor supervision at a senior level can have a similar effect.

Suppliers: The cost of victualling directly affects crew numbers and in some cases by the ratio of officers to ratings if the feeding standards are different. In the same way the nationality of the crew can also affect the costs of victualling due to differences in feeding standards. A poorly supervised or inefficient crew can be wasteful in the use of all supplies.

Insurance: Frequent claims made on the shipowner's insurance policy because of accidents caused by crew negligence or inefficiency can cause an increase of premiums not only to the ship but to the whole of the shipowner's fleet. Crew of poor health and stamina can also affect the cost of insurance if too many claims are made for expensive medical attention and repatriation of crew members.
SUPPLIES: Deliberate purchasing of supplies below quality specification, or lack of attention in entering that suppliers specifications are met in such items as paint, lubricating oils and food can affect the maintenance of the ship and the performance of the crew.

INSURANCE: Inadequate hull and machinery insurance cover can result in repair claims being refuted and the cost falling on the technical department. In the case of serious accidents, crew and suppliers costs can also be affected. Inadequate medical insurance can result in increased crew costs.

ADMINISTRATION: Inadequate administration ashore, both directive and supportive can also result in higher costs in all areas. If the establishment is inadequate it will be impossible to carry out the required work load with the following effects.

General: Inadequate regulations instructions and policies can involve all departments of the company in legal and other costs.

Crew: Poor planning can result in high travel costs and insufficient attention to crew recruitment and selection can result in unsatisfactory crews.

Supplies: Poor planning and consideration of the availability of world supplies, prices and market condition can result in unnecessarily costly purchases. Rectification of errors in ordering supplies can be time consuming and expensive.

Technical: Poor planning and instruction can result in costly maintenance and repairs.
Insurance: Poor claims procedures, both ashore and on ships, plus poor record keeping and control of claims, can result in "losses" or higher costs in all departments and may well affect the insurance premium costs.

To summarise

The present grouping of ships' cost centres into five department have evolved through the development of the ship itself and changing philosophies of control. It has now reached a stage where the groups or departments are as much associated with activities or functions and areas of expertise as with the departments in the ship or ashore.

There are three important points:

No department or group of costs stands alone; each is related to the other and the action or lack of action of one can affect the others to varying degrees.

The department which has the greatest effect on the others is the crew department.

Cost centres can be arranged in any way, but no matter which way they are arranged, they must all be considered.

Crew Costs

Basis of crew costs

Crew costs are based on three related factors:

The manning scale prescribed for the ship

The nationality or nationalities of the crew.

The conditions of service.

The manning scale: In the first place this is dependent upon the statustory requirements of the government of the country of registry, particularly in regard
to the certification of officers. In the second place, the scale depends upon any existing national or individual agreements between owners and unions and the owner's own policy as to the size and "mix" of the crew.

The nationality of the crew: Is dependent upon the same requirements as the manning scale although not all governments insists on the crew being of a particular nationality.

The conditions of service: Are the rates of pay, leave, overtime and other fringe benefits received by the crew. They are usually graded according to the size of type of ship i.e. freighter, tanker, coaster etc., and are often subject to minimum requirements set by governments, unions or joint bodies representing both owners and unions. Minimum scales and requirements are often supplemented by ship owners to attract higher quality crews to their ships. If special systems of work are operated, such as general purpose (GIP) or inter department flexibility (IDF) they are supplemented by agreements negotiated with the unions.

Again, as with all costs, there is no rule about the way they should be grouped and it is a matter for company policy whether to differentiate between direct and indirect costs. Convention and convenience play a part and following arrangements of costs within the three groups is fairly typical.

Wages: (Direct)

- Basic pay
- Overtime
- Special work payments
- Leave pay
- Leave subsistence
- Bonuses
Social security

Superannuation

Crew overlap

Travel: (Direct)

Rail, road, ship and air fares

Accommodation and meals

Travel subsistence

Baggage costs.

Other Costs: (Indirect)

Medical examinations

Medical treatment

Union payments

Manning agent’s fees

Cadet training

Levies

Training costs

Study leave and pay (for certificated of competency)

Standby pay

Recruitment

Although it is usual to allocate the costs of wages and travel directly to the ship concerned, the treatment of other costs will vary from company to company particularly in the case of training, study leave and standby pay. These may be allocated to ships directly or added together and apportioned to the fleet as a whole.

Wages

The treatment of crew pay can be considered in two ways:
(a) For the casually employed crew

(b) For the continuously employed crew

Dealing with the casually employed crew is relatively straight forward. A crew member is engaged for a voyage i.e. a period of time, and at the completing of his employment his services with the ship and owners are terminated. On leaving the ship he collects the balance of wages, overtime, leave pay, bonuses etc, due to him after deductions have been made for any payments made to him during the voyage, or on his behalf such as income tax, union dues or his own proportion of any social services contributions.

In the case of continuously employed crew members the treatment of pay is more complex and it is as well to examine some of the basic reasons and problems of employing crew in this way. From the shipowner's point of view it provides continuity; the employment of men who know his policies and his ships and who are, generally, available when he wants them. There are savings in recruitment costs and benefits in improved care of his ships. From the point of view of the crew member there is the benefit of regular employment with, perhaps, a company pension and often regular payments into his bank account each month. At the end of his leave he does not have to seek a new employer whose ways and ships he does not know.

Travel

Travel costs have three basis components:

The cost of the travel itself which may involve a number of modes of travel and the cost of excess baggage when flying to or from a ship. The cost of accommodation while waiting to commence the journey and during and after the journey.
The cost of meals or payments in lieu of meals, i.e. subsistence, during the travel period.

The cost of travel depends to a large extent upon the trading pattern of the ship, the place or origin of the crew, the required frequency of crew changes and the skill of the manager responsible for scheduling the changes. Ideally all the crew should be changed at one time at their home port, but unfortunately this is rarely practiced as the technical management usually require a phased change-over, particularly of senior officers, to ensure continuity of operation. Additionally crew members may leave the ship during the voyage for ill health or for compassionate or other reasons and thus, in time, a number of the crew can be found to have joined the ship at different times, making changes of large groups of men more difficult.

Despite the difficulties, the crew manager will still endeavour to change as many crew members as possible at the same time and as near as possible to their place of origin. In this way he can obtain maximum discounts for group travel and accommodation.

Co-ordination with the ship's operators is very important if costly delays to the ship or in the cost of men awaiting a ship's arrival are to be.

Other costs

These are often considered to be indirect and may be apportioned to the fleet if the owner has more than one ship. This group includes the items listed earlier in the above on which the following comments can be made.

Medical examinations and treatments: Covers all costs not covered by insurance
Clothing/Uniform: The supply of working clothes to crews has increased through the years and crews originating from hot climate areas are often issued with cold weather clothing. It is not unusual for catering staff to be issued with tunics and there is also a trend to supply officers with insignia and sometimes uniforms as well.

Manning agents fees: Some owners obtain their crews completely or partially through agents who take on the general responsibilities of the crew department at an agreed fee.

Cadet Training: There are arguments that all who benefit from cadets as future officers should share in their training costs. In some countries shipowners are required to accept a certain number on their establishment while others operate a penalty scheme or "levy" which must be paid into a national fund by shipowners who do not train cadets, to compensate those shipowers who do train them. Training schemes in some countries are very complex and expensive, involving the cadets in long periods ashore in residential colleges.

Levies: In some countries shipowners group together to form a central administrative, negotiating and training organization. Such organizations are paid for by applying proportionate charges or levies to the shipowners who receive rebates if they contribute to the industry by employing deck boys, cadets etc.

Training: Although officers are required to hold certificates to fill certain positions in the ship, some shipowners require them to undergo additional training. Such courses includes shipboard management, ship handling simulation, safety & survival in addition to those courses now proposed by IMCO, or national governments. The costs of these courses with accommodation and travel can be high but the benefits to the shipowner are considered by many to be worthwhile.
Study leave and pay: Some national agreements require that companies pay for the costs of an officer studying for his certificates of competency and associated certificates. The amount of payment is dependent upon an officer's length of the company, but continuously serving officers are kept on full pay for specified study leave.

Standby pay: This is the cost of men awaiting appointment. A skilful crew manager will endeavour to keep such payments to a minimum, by appointing a crew man to a ship or sending him on a course immediately his leave is finished.

Recruitment: Whether or not it is the company's policy to employ staff continuously, costs are usually incurred under this heading through the medium of advertising and subsequent interviewing and selection, or the use of and agent, or joint industrial recruitment organization. The cost of direct advertising will depend on the availability of staff. In general it can be said that the more stable the company's establishment the less the need to recruit and the lower the costs under this heading.

Technical costs

General

The technical department's costs cover all costs associated with the maintenance and repair of the ship to the state required by the owners. Generally, this means keeping the ship fully operational for the maximum number of days possible in the year, but it can also cover lay up, modifications and the sale or purchase of the ship. If operational, the level of maintenance and repair must conform to statutory and classification standards, but beyond this the level of maintenance and repair depends upon the company policy at the time.
Ideally a ship should be maintained to an optimum level at all times i.e., it should conform to regulations, maintenance should be continuous such as to avoid breakdowns and the ship should have a reasonably smart appearance. Unfortunately, the economics of the shipping industry are all too often reflected in the levels of repairs, maintenance and appearance as more or less money is available. Insufficient maintenance can be a short-sighted policy as the incidence of breakdowns will inevitably increase, but when cash is in short supply long-sight usually suffers from shortage also.

The Costs

Technical costs involve the costs of labor, skills, expertise, parts, materials, tools and equipment.

The labor and skills:

These come from:

The crew.

The shipyard and ship repairs.

Additional crew from time to time.

Contract labor (riding crews) sailing in the ship.

Experts sailing in the ship or attending in port.

Consultants and surveyors.

The shore staff of the shipping company.

Some of the work in which these skills are utilized can only be done in port and some of that work alongside in a specially fitted ship repair yard. Other work can be done at sea or in port as management chooses, but the amount of work done by the crew itself will depend upon the size, quality and mix of people on board the ship.

The labor and skills are utilized in four distinct but related ways:
Operating: Actually running and manoeuvring the ship and equipment.

Monitoring: Assessing the performance of the ship and equipment.

Maintaining: Examining, overhauling, renewing and protecting, preferably on a planned and systematic basis.

Repairing: Putting right damaged or worn structure, parts and equipment, either temporarily or permanently.

The operational activities are essentially carried out by the crew, the monitoring by crew and shore staff and occasionally experts, and the maintenance and repairs by crew or shore staff depending upon the type of work and availability of manpower as explained.

The crew are the only people under the direct control of management and the way in which their available skills are utilized for maintenance can have an important effect on technical costs. It must be borne in mind that the prime functions of the crew are to run and operate the ship and, whenever possible, to restore the ship to an operational state as quickly as possible if something goes wrong. Time available for maintenance can be minimal unless the manning scale is geared for the crew to do such work to any appreciable extent.

Regardless of the manning scale, a crew's availability for maintenance can be severely restricted by weather conditions, (cold, heat, humidity, gales), standby conditions in fog and approaching and leaving port, watch keeping and occasionally sickness. The advent of the automated and partially automated engine has improved this situation by freeing engineers and engine ratings from watchkeeping away from land, thus allowing them time to carry out more maintenance than with a manned engine.
However, regardless of who does the maintenance work, the prime objective of such work is the avoidance of breakdowns with resultant time out of service or "off hire", and the maintenance of operational efficiency.

Part and Materials:

Without the parts, known as "spares" or "spare gear" or materials, i.e. supplies, maintenance and repairs cannot usually be effected. The high costs of some spares and materials makes over-stocking in ships a needless expense, but lack of availability and high delivery costs if sent by air freights, can cause even higher costs particularly if a ship is delayed awaiting such spares.

Tools and Equipment:

Just as maintenance and repairs cannot be carried out without spares and suppliers, neither can the work be carried out without the proper tools. Work studies of shipboard maintenance and repairs have been known to have found men standing around waiting to share a hammer. There is no excuse for a shortage of low cost, frequently used tools in a ship. The purchase of higher cost equipment obviously needs careful consideration but if it saves time and helps to progress maintenance it should either be purchased or the work left to be done in a repair yard or special workshops, where such equipment is available.
Instruction, training, methods and progress

Indirectly associated with costs are the instructions of management to the crew and, in some cases, to other people involved in the ship. From the point of view of technical costs, proper operating instructions and guidance should be given whenever possible as malpractices can often result in costly repairs in all parts of the ship.

Correct operational procedures, safety and accident prevention are associated with proper training in running the ship and its equipment. It is, therefore, most important that management identifies the needs of the crew and ensures that they are adequately trained. Although in some countries the national qualifications required for seafarers have widened their scope to include courses on radar operation, fire fighting and tanker safety, there are still a number of areas where specialist training is required in the best interest of the crew and ship, such as turbo blower maintenance and particularly to efficient operation of ship’s systems e.g. the manual operation of automated equipment.

Studies of work practised in ships have resulted in a number of improvement, not only in the tools and equipment for carrying out maintenance and repairs, but also in the methods of doing such work. This has reduced the time involved and thus increased the amount of work which can be done. Studies of the number of running hours required before overhaul together with careful and scientific monitoring have also reduced the frequency of overhauls. Special hull coatings have improving the reliability of ships, in the hope of further reductions in maintenance and repair costs. The effect of these advances will be considered in greater depth.
Cost Centres and Groups

Technical cost centres can be virtually the same for any ship with the exception of a few specific costs associated with the purpose of the ship, for example, the tank washing equipment in tankers and the refrigeration equipment and piping in reefer ships.

However, the magnitude of costs for the same cost centres can vary considerably e.g., the cost of tank anodes will be higher in a tanker than a general cargo ship; spare parts will cost more in a motor ship than in a steam ship; tank top damage will be greater in a bulk carrier through the use of grabs than a container ship, and ships which discharge cargo into lighters at anchorages can expect greater hull damage and corrosion through rust than ships which usually lie quietly alongside a berth.

The grouping of technical costs is based more on tradition, convenience and staff function than on magnitude. For example charts, safety, infestation etc., may be grouped under "marine" if this area is in the charge of a marine superintendent or inspector. This shows an arrangement of costs in ten second category groups as follows:

Hull: All structure, decks, fittings, lifeboats, derricks etc.

Engine and Electrical: All machinery and associated equipment.

Radio and Navigational Aids: All electrical and electronic equipment under the heading

Spare Gear: The costs of hull, engine and electrical and ratio and navigational aid spare parts.

Marine: Charts, safety equipment, lifesaving equipment not attached to the ship, disinfestation.
Surveys: The cost of surveys.

Note: there is a trend for some classification societies to allow properly qualified and experienced ships personnel to carry out some specified surveys on their behalf.

Consultants: This covers a wide area of expertise brought in to solve problems, or to supplement existing shore staff etc. It includes riding crews and also the expense of technical shore staff directly attributable to a specific ship. The apportionment of other costs will be explained on administration budgets.

Registry: The costs of survey fees, licenses, registration fees etc., associated with the registry of the ship.

Accommodation - interior: The costs of all interior repairs to accommodation including hard furnishing but excluding soft furnishings.

Modifications: Covers changes in the structure or equipment of the ship to comply with changes in legislation or the trading of the ship. This is usually "capitalised" and thus There is a need to separate it from other costs. When a number of modifications are taking place at the same time it may be necessary to have a number of items under this heading e.g. loadline change, IMCO/pollution, SAFCON, installation of heating coils etc., in order that the shipowners can assess what are, in effect, the costs of such changes.

Supplies Costs

Supplies costs can be arranged into any number of groups but the groups which follow are fairly typical. Ships carrying crew will probably require additional groups to cover such items as cutlery and bed linen separately because of their costs in those ships.
<table>
<thead>
<tr>
<th>Cost Group</th>
<th>Responsibility for ordering</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marine Stores, including all paints, Ropes &amp; wires and Fresh Water</td>
<td>1st mate</td>
</tr>
<tr>
<td>Engine Stores, including all greases Packing etc. Lubricating Oils.</td>
<td>Chief Engineer</td>
</tr>
<tr>
<td>Stewards Stores, including all cleaning Materials, stationery, linen, cutlery, Laundry and soft furnishings Victualling. Recreational. Clothing. Handling Charges. Bar and Canteen. Marine stores Safety: Includes all items associated with the safety equipment certificate requirements; lifeboat stores, life saving equipment, firefighting equipment, pyrotechnics etc. As can be well understood, this is one area of stores which must be always complete and articles with stated expiry dates must be renewed before the due date regardless of apparent condition. Paints: In addition to routine maintenance painting by the crew, dry docking and major refits involving hull and hold painting will require large quantities of paint which are ordered in consultation with the technical</td>
<td></td>
</tr>
</tbody>
</table>
department ashore and the paint suppliers to ensure compatibility of the coatings and that supplies are available at the port where the work is to be carried out.

Cargo equipment: Must conform to the Factories Acts and other similar national regulations. This cost group is large in cargo ships while on ships gangways and accommodation ladders and access and lifting equipment. Certification of supplies under this heading is an important factor.

Ropes, cordage and canvas: Includes all ropes from mooring ropes and wires to the lacing of boat covers. Mooring ropes and wires associated with cargo gear are also covered by certificates.

Deck stores: Include deck tools and painting equipment, flags etc., and various non-designated items.

Fresh water: As a budget item this has reduced in size in recent years due to installation of fresh water generators in ships. However, it can be a large item during dry docking and survey periods.

Engine stores.

Chemicals: Includes chemicals used for refrigeration, degreasing, tank cleaning and in the maintenance and operation of machinery.

Gases: Includes CO2, Freon, Acetylene and other gases.

Electrical: Covers all electrical "consumable" items such as electric light bulbs and other electrical parts such as neon tubes, light shades, plugs etc., not generally considered spare gear.

Engine room stores: Includes the many miscellaneous items required for the operation of machinery: packing jointing, greases, testing equipment, tools, fastenings, abrasives etc.
Lubricating oil

Close liaison with the technical department ashore is required when ordering lubricating oils. Care must be taken in considering and observing makers' instructions as to grades of oil to be used for individual items of equipment and the availability of some grades of oil in certain parts of the world. It is preferable not to change brands without first checking the compatibility of the oils. And should be noted that availability and world price differentials need careful consideration when arranging supplies.

Steward's stores

Cleaning: Includes all materials used in maintaining the cleanliness of the ship, such as detergents, soaps fumigators etc.

Stationery: There are two basic types; company printed stationery such as forms, indents, report etc. and standard stationery such as note books, pencils, type writer ribbons, typing paper etc. It is usual for there to be a separate standard ordering form for company stationery as this is normally supplied direct from the company's office ashore.

Accommodation & galley: Includes the following three cost centres:

1. Table and cabin linen (table cloths, sheets, towels, etc.)
2. Crockery and cutlery (knives, forks, cups, glasses etc.)
3. Cooking and serving utensils (pots and pans etc.)

Laundry ashore The costs under this heading can vary considerable, as in some ships a laundryman is carried who launders all the ship's linen, while in others the soiled linen is sent ashore, often at high cost. Alternatively in ships with appropriate equipment one of the crew will carry out the task for extra payments. This, like the technical costs is another example of the costs of one
department reflecting on another, supplies costs reduce, apart from the soaps, etc. used in the laundry. Even technical costs are involved if laundry equipment is fitted in the ship.

Soft Furnishing Includes carpets, curtains, loose covers, mattresses, etc. and is the one area of supplies costs which can vary considerably with time. In a new ship there may not be any costs under this heading for some years, and then a gradual increase as replacements are made.

Note: furnishing include chairs, tables, cabinets etc, and these are usually considered to be a technical cost.

Victualling: Can be arranged in three distinct ways, although from the point of view of accounting, budgeting and bookkeeping the same cost centre can be used.

The three ways are:

1. A daily allowance is paid to the crew, either directly or through the master or chief steward, and they purchase their own food and make their own catering arrangements.

2. The company pays a victualling agent a fixed amount per man per day and he arranges all victualling on a world wide basis. This arrangement usually requires the steward or cook/steward to be an employee of the agent.

3. The company provides all victualling.
The Cost of Insurance

Protection against loss or damage

There are few guidelines and tariffs and most insurance rates are established through market forces. However, in the first place the shipowner must have an insurable ship, i.e. a ship worthy of being insured. The more worthy in terms of condition, age, management, flag, crew, type of trade etc., the easier it will be to obtain a leader's acceptance at a reasonable rate.

Budgeting for Insurance costs

As will have been realised, there are very few cost centres in the insurance department and four will suffice:

- Hull and Machinery (H&M) i.e. loss and damage
- P & I i.e. liability
- War Risks
- Loss of Earnings

Administration Costs

"Administration" or "Overheads" are the names given to the costs of providing a base or central point from which the shipping company is run or administered. The function of the shipping company's administration is split into two distinct but related parts; the corporate , which directs the company as a whole and makes long term plans, and the ship management and operations which deal with the day to day management of costs and earnings as described.

The function

The prime functions of ship management administration are:

- Ship support
- Record keeping
Accounting

Communications

Ship support: Ships need shore support and this is a prime role of the shore base. Crews must be recruited, trained, changed etc., supplies must be ordered, arranged, and technical maintenance must be planned and arranged and spare gear ordered; and insurance cover must be placed and accounts of all financial matters must be kept.

But support is not just the arranging, and planning ordering of crew parts and repairs etc. It is also the formation and issue of adequate regulations, instructions, advice and guidelines to ships. Apart from the "legal" requirements for adequate company regulations, ship staff need proper instructions, advice and information on a whole range of matters from safety, changing international regulations, new equipment and even from safety, changing international regulations, new equipment and even the correct use of detergents. The way in which such documentation is presented is very important and requires skilled staff to ensure that everything issued is easily assimilated and kept up to date.

Record keeping: The value of keeping proper records cannot be overstressed. Apart from the company's own requirement for performance monitoring, maintenance, insurance claims, crew records accounts, etc., in any sort of litigation there is usually a need to show that the company has managed and supported the ship in a professional manner and good records can usually provide the necessary evidence.

Accounting It is necessary to add the sufficient staff must be employed to keep an up to date set of books and provide management with the information it needs.
Communications: Although this is more a service than a function, the need for a good system of communications between ship and shore is essential in a well run shipping company. Some methods of communications are more expensive than others and it is important for the ship manager to provide concise instructions on when and how communications should be made.

Summary of costs departments

The cost centres having been considered in detail and arranged into departments it remains for the total costs to be added together to produce the costs of running the ship i.e. the "Running Costs". They can then be presented to senior management in a concise form and also to the operators for inclusion in their voyage costs calculations.

And about stage that an allowance for the ship's depreciation and any interest charges are often added to the running costs, although these are outside the control of the ship manager. The interest charges are the costs of bank loans or mortgages and the depreciation charges on the above.

2.2 Current Problems and Areas for Improvement

There are some problems with the current process. The problems can be summarized as follows:

(a) The existing system mostly done manually and uses MS Excel to manage all decision information and prepare all adhoc reports.

(b) No automatic report generating, each report will be prepared case — by case. There is no stable version of a report even if the information in each report is the same, with only different formats and print dates.

(c) No documentation management system, the raw data will be kept in folders and there is no database to keep track of documentation.
There are some redundancies in the process because the data for each division are not centralized. One division has to create a database, which is similar to others. The problem can be reduced by a good database management system.

The current business of ASVCS has been changing a lot. The modification and updating of information is a must. This is a time-consuming process and needs a high volume of manpower. Therefore, there are problems of i) high cost of people to manage data, ii) slow ASVCS working process, and iii) low efficiency of getting information.

The data record of the current process is old-fashioned. It is a manual process, which consumes time and paperwork. There is a need to keep space for data records.

If information is not available on time, the data is not up-to-date, thus customer information is misguided. One result is a lack of control over the budget for charging customers for service provided.

The existing marketing information is held separately by the responsible person in the department so no one else can access the information using their own LAN password. It is not secure enough to keep the proprietary marketing information separately because if the files are destroyed, no-one can retrieve them.

Areas of improvement are; I) having a good database management system within the department or across function, II) having a standard process to backup hard copies without redundancy, III) setting up a central person to consolidate all information.
2.3 Existing Computer System

(a) Nathalin has provided all users the facility to access the company network using Client/Server Architecture. Each user will get a company PC and all peripherals.

(b) Each user client will be connected to the Nathalin LAN environment.

(c) All applications software will be kept in the Server, the client will keep only the necessary system files to run each software application.

(d) The local applications, tailor-made for specific users, like this system will be kept in the application - shared drive or the Department shared drive.
III. THE PROPOSED SYSTEM AND REQUIREMENT ANALYSIS

3.1 Overview of The Proposed System

The Analysis of a Sea Vessels Costing System (ASVCS) is a computerized database system for use, analysis, and control project in Business Development Division. Currently, BD has developed a strategic plan i.e. outsourcing can audit and view the estimating in various reports. Therefore, we need to improve the BD database capability to cope with those changes.

The ASVCS is created with the aim of centralizing and managing the BD database on a PC system. By being separate from the existing LAN system, the
ASVCS can import raw data in costing in computerize conveniently and more effectively. Since the current procedure separates people working on different pieces of data, it is very difficult and time-consuming to collect all the useful information. Management cannot gather data on time thus the decision making is delayed. Concurrently, the current LAN is a high-performance system which needs time and experienced programmers to be utilized effectively, thus creating inflexibility.

For instance, if one wants to update equipment in the central area and print out a non-existing report, approval from management is needed and then a request must be made to the analyst to create that report. The process takes time and there is a lot of backlog from system. This is not a practical way to serve the current BD business needs.

Therefore, creating on BD database management centered on a PC would reduce all constraints, including the processing period, tremendously. The main reason is the ASVCS would be a smart and easy program to create, develop, update, and change. Furthermore, the Microsoft Access program is easy to learn because it is Window-based software about which all users already have basic knowledge and skills.

3.2 User Requirements

(a) BD clerk, supervisors
(b) Planning analyst and management
(c) Other Department and Divisions
(d) System administrator
3.3 New Proposed System and System Design

Please see the overall process in the context diagram, BD data flow diagram Level 1 on appendix A.

3.4 System Requirement

There are some requirements to develop the ASVCS project. These are staff, hardware, and software. Furthermore, management support is one of the most important aspects.

(a) Key staff/Assessment

(1) Program initiative/programmer.
(2) Assistance/coordinator — key users to key in data.

(b) System Requirement

Hardware

(1) Computer CPU speed 2.6 Ghz
(2) Hard disk 40 GB and memory 128 MB
(3) Lan Card 10/100
(4) Switching Hub 24 ports
(5) RJ 45 and CAT 5E twist pair wire.

Software

(1) Operation System eg. Windows 98, me, 2000 and XP.
(2) Visual basic 6 and Crystal Report.
(3) MS — ACCESS 2000 for database
(4) TCP / IP protocol to transfer data in LAN

Nathalin provides the facilities to users such as a file server and other sharing peripherals in the main computer room. Therefore it is not necessary to mention the FI/W required for the system.
Network specification

All user clients are located on the 3rd floor and the server room is located on the same floor. A hub link is used to transmit the information between the LAN Environment and distribute the signal spread on each floor.

3.4 Security and Control

System security and control is separated into 2 categories: Accessing System Security and Change Control Procedure.

Figure 3.2. Security System.
Accessing System Security

There are many security controls in Nathalin Group to regulate system access. They are:

(a) A guard on the main lobby to check non-Nathalin employees. To enter each floor, users have to use an access card (Physical Security).

(b) To open a PC, users have to enter the power on password setting at the CMOS of each PC (Logical Security).

(c) To access the LAN Environment, users have to use their own LAN Password (Logical Security).

(d) To access the system, users must have permission to access the Department LAN shared Drive.

(e) To access the system, users have their own password assigned by the system administrator.

(f) Permission to see, read or execute the object is not the same. A user workgroup type will be allowed to open and update only one form in the system.

In order to update information, users have to ask for approval from the system owner. The system administrator will have permission to update all objects in the system.

System Password

Users will be assigned and least 5 digit system password to access the system and must change their password periodically.

LAN shared area NT permission

The system will be located a

ServerName\Server Share Name\Path Department Share\DBMS
To access the system, permission will be separated into 2 groups:

1. Admin Group -- Read Write Delete
2. User Group -- Read Write

Table 3.4. Security Policies on Database.

<table>
<thead>
<tr>
<th>Object in the system</th>
<th>Admin Group</th>
<th>User Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table</td>
<td>R,W,D</td>
<td>R,W</td>
</tr>
<tr>
<td>Query</td>
<td>R,W,D</td>
<td>-</td>
</tr>
<tr>
<td>Form</td>
<td>R,W,D</td>
<td>R,W</td>
</tr>
<tr>
<td>Table</td>
<td>R,W,D</td>
<td>-</td>
</tr>
<tr>
<td>Report</td>
<td>R,W,D</td>
<td>-</td>
</tr>
<tr>
<td>Macro</td>
<td>R,W,D</td>
<td>-</td>
</tr>
</tbody>
</table>

Remarks: (R — Read, W — Write, D — Delete)

3.5 Cost Benefit Analysis

The assumptions are based on actual practice and all numbers in the assumption are estimated since some information is proprietary.

(a) The cost/benefit analysis will compare the proposed system with the existing system and how the proposed system can:

1. Save cost for the company
2. Allow users to work better and perform their work more efficiently
3. Provide a systematic documentation management system
4. Provide automatic report generating tools.
(b) The analyst's work costs 1,000 Baht per day.

(c) Electrical power cost per hour per 1 computer is 25 Baht.

(d) Administrative and operator costs per day are 430 Baht/day, 54 Baht/hr

(e) Indirect wasted cost is 30 Baht/hr/day

(f) Paper supply cost per 1 unit is 0.15 Baht

(g) 1 work day = 8 hours

(h) There are 3 analysts to do reports in the existing system

Table 3.5. Expenses of the Existing System.

<table>
<thead>
<tr>
<th>Analyst working cost (1 person)</th>
<th>1,000 Baht</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 analysts</td>
<td>3 persons</td>
</tr>
<tr>
<td>Total</td>
<td>3,000 Baht/day</td>
</tr>
<tr>
<td>At least 2 days per 1 report</td>
<td>2 days</td>
</tr>
<tr>
<td>Total — 1</td>
<td>6,000 Baht --- 1</td>
</tr>
<tr>
<td>Indirect wasted cost</td>
<td>30 Baht</td>
</tr>
<tr>
<td>Paper Supply (40 units * 2 days * 0.15 Baht)</td>
<td>12 Baht</td>
</tr>
<tr>
<td>Electrical power (25 Baht * 8 hours * 2 days * 3 persons)</td>
<td>1,200 Baht</td>
</tr>
<tr>
<td>Total — 2</td>
<td>1,242 Baht --- 2</td>
</tr>
<tr>
<td>Net Total Cost per 1 job</td>
<td>7,242 Baht --- 3</td>
</tr>
</tbody>
</table>
The Existing system

To perform BD analyst work, they have to:

(a) Print reports which uses paper 40 units of pages per day including unnecessary reports printed in errors.

(b) Have an manager of each department verify the document manually, 2 hours.

(c) One report or one job assigned may be generated in a new version case by case.

This may take more than 2 days to complete.

On average, there are at least 2 jobs per month. Therefore the estimated cost incurred in 1 month is 14,484 Baht (7,242 Baht * 2 Job).
The Proposed System

To perform the **BD** analyst work, they have to:

(a) Print reports using 10 units of papers per day (no human error because the system will generate automatic reports from the database).

(b) Have one supervisor verify the document manually, 1 hour.

(c) No Adhoc reports anymore. If there is a report request, the analyst will print the report from the system in 2 seconds.

Table 3.6. Expenses of the Proposed System.

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analyst working cost (1 person)</td>
<td>1,000 Baht</td>
</tr>
<tr>
<td>1 analysts</td>
<td>1 persons</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1,000 Baht/day -- 1</td>
</tr>
<tr>
<td>Indirect wasted cost</td>
<td>30 Baht</td>
</tr>
<tr>
<td>Paper Supply (10 units * 1 days * 0.15 Baht)</td>
<td>1.5 Baht</td>
</tr>
<tr>
<td>Electrical power (25 Baht * 8 hours * 1 days * 1 persons)</td>
<td>200 Baht</td>
</tr>
<tr>
<td><strong>Total --- 2</strong></td>
<td>232 Baht --- 2</td>
</tr>
<tr>
<td><strong>Net Total Cost per 1 job</strong></td>
<td>1,232 Baht --- 3</td>
</tr>
</tbody>
</table>
On average, there are at least 2 jobs per month. Therefore the estimated cost incurred in 1 month is 2,464 Baht (1,232 Baht * 2 Job).

The cost comparison summary for 1 year is shown in the table below:

Table 3.7. Comparison Net Saving Between Existing and Proposed System.

<table>
<thead>
<tr>
<th>Month</th>
<th>No of jobs</th>
<th>Existing system cost</th>
<th>Proposed System Cost</th>
<th>Net Saving</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan.</td>
<td>2</td>
<td>14,484</td>
<td>2,464</td>
<td>12,020</td>
</tr>
<tr>
<td>Feb.</td>
<td>3</td>
<td>21,726</td>
<td>3,696</td>
<td>18,030</td>
</tr>
<tr>
<td>Mar.</td>
<td>2</td>
<td>14,484</td>
<td>2,464</td>
<td>12,020</td>
</tr>
<tr>
<td>Apr.</td>
<td>2</td>
<td>14,484</td>
<td>2,464</td>
<td>12,020</td>
</tr>
<tr>
<td>May.</td>
<td>2</td>
<td>14,484</td>
<td>2,464</td>
<td>12,020</td>
</tr>
<tr>
<td>Jun.</td>
<td>3</td>
<td>21,726</td>
<td>3,696</td>
<td>18,030</td>
</tr>
<tr>
<td>Jul.</td>
<td>2</td>
<td>14,484</td>
<td>2,464</td>
<td>12,020</td>
</tr>
<tr>
<td>Aug.</td>
<td>1</td>
<td>7,242</td>
<td>1,232</td>
<td>6,010</td>
</tr>
<tr>
<td>Sep.</td>
<td>2</td>
<td>14,484</td>
<td>2,464</td>
<td>12,020</td>
</tr>
<tr>
<td>Oct.</td>
<td>2</td>
<td>14,484</td>
<td>2,464</td>
<td>12,020</td>
</tr>
<tr>
<td>Nov.</td>
<td>2</td>
<td>14,484</td>
<td>2,464</td>
<td>12,020</td>
</tr>
<tr>
<td>Dec.</td>
<td>2</td>
<td>14,484</td>
<td>2,464</td>
<td>12,020</td>
</tr>
<tr>
<td>Total 1 yr.</td>
<td>25</td>
<td>181,050</td>
<td>30,800</td>
<td>150,250</td>
</tr>
</tbody>
</table>
which will be provided to all users through the company e-mail. Users will access the system if the ID and password are corrected (See Figure 4.2.)

![Figure 4.2. Accessing the System.](image)

The first interface of the system will be the logo and the name of the system. All options and menus are designed to be user friendly (See Figure 4.3 First Screen of the system).)

There are 6 main options on the screen

1. Enter/View Cost Reports by Each Department
2. Enter/View Other Information...
3. Preview Reports
4. Change Switchboard Items
5. Exit this database
The Main Screen (Shown in Figure 4.4.) will provide all cost information.

Users will input all information in the Main Screen.

Figure 4.3. The First Screen of the System.

Figure 4.4. Cost Information Main Screen.
Figure 4.5. Print Report Main Screen.

From this screen users can print report into 2 groups:

1. Print Report by Costs Category
2. Print Report by Financial Statement and Forecasting e.g. Cash Flow, Estimated Profit & Loss, B.E.P etc.
4.2 Report Design

There are 10 reports in the ASVCS DBMS application. There are 2 categories of reports. The first report is the report that replaces the manual hard copy, which includes all information kept in forms. The second report is the report that will support management decision-making.

However, there are 10 reports to be shown in this paper which are:

1) Project Overview

2) Before Operation Costs

3) Variable Cost

4) Detail of Fix and Variable Costs

5) Cash Flow of Project

6) Profit & Loss of Long Term Project

7) Detail of Internal Rate of Return (IRR)

8) Detail of Payback Period

9) Detail of Break Even Point

10) Summary of Project
5,000 DWT. Sea Vessel Planning

INVESTMENT

<table>
<thead>
<tr>
<th></th>
<th>MILLION BAHTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 PRICE OF VESSEL 5,000 DWT</td>
<td>84.83</td>
</tr>
<tr>
<td>2 BEFORE OPERATION EXPENSES</td>
<td>13.75</td>
</tr>
<tr>
<td>3 ROLL OF INVESTMENT</td>
<td>-</td>
</tr>
<tr>
<td>Exchange Rate :</td>
<td>98.58</td>
</tr>
</tbody>
</table>

TOTAL 2.28 USD

INVESTMENT STRUCTURE

<table>
<thead>
<tr>
<th></th>
<th>MILLION BAHTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL OF INVESTMENT</td>
<td>99.00</td>
</tr>
<tr>
<td>- SHARE HOLDERS 25%</td>
<td>25.00</td>
</tr>
<tr>
<td>- LOAN 75%</td>
<td>74.00</td>
</tr>
</tbody>
</table>

REMARK

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 PRICE OF VESSEL</td>
<td>9.28 MB / YEAR</td>
<td>57</td>
<td></td>
</tr>
<tr>
<td>2 BEFORE OPERATION</td>
<td>6% (INTEREST OF RATE)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 ROLL OF INVESTMENT</td>
<td>10%</td>
<td>5%</td>
<td></td>
</tr>
<tr>
<td>4 IRR 10 Years</td>
<td>74 MILLION BAHTS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 IRR 8 Years</td>
<td>5.60 MB / MONTH</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 Payback Period</td>
<td>100</td>
<td>5%</td>
<td></td>
</tr>
<tr>
<td>7 Payback FOR SHARE HOLDER</td>
<td>48.87 %(FIRST YEAR)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>51.62 %(AVG 8 YEAR)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 4.1. Structure of Cost.

<table>
<thead>
<tr>
<th>VARIABLE COST</th>
<th>MILLION / YEAR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BUNKER &amp; LUBRICANT</strong></td>
<td>7.71</td>
</tr>
<tr>
<td><strong>MDO</strong> = 11 Lts / Hrs</td>
<td></td>
</tr>
<tr>
<td><strong>MFO</strong> = 130 Lts / Hrs</td>
<td></td>
</tr>
<tr>
<td><strong>1.1 RYG - PKE - RYG</strong></td>
<td>280 HRS</td>
</tr>
<tr>
<td>- MDO = 3,080.00 Lts @ 11.60 BAHT = 35,728.00 BAHT</td>
<td></td>
</tr>
<tr>
<td>- FO 180 = 36,400.00 Lts @ 8.78 BAHT = 319,592.00 BAHT</td>
<td></td>
</tr>
<tr>
<td>- LO = 6.00 Lts @ 30.20 BAHT = 1,812.00 BAHT</td>
<td></td>
</tr>
<tr>
<td>- CY = 145.00 Lts @ 32.50 BAHT = 4,712.50 BAHT</td>
<td></td>
</tr>
<tr>
<td><strong>1.2 RYG - BKK (18G i No. 30)</strong></td>
<td>45 FIRS</td>
</tr>
<tr>
<td>- MDO = 495.00 Lts @ 11.60 BAHT = 5,742.00 BAHT</td>
<td></td>
</tr>
<tr>
<td>- FO 180 = 5,850.00 Lts @ 8.78 BAHT = 51,363.00 BAHT</td>
<td></td>
</tr>
<tr>
<td>- LO = 20.00 Lts @ 30.20 BAHT = 604.00 BAHT</td>
<td></td>
</tr>
<tr>
<td>- CY = 22.00 Lts @ 32.50 BAHT = 715.00 BAHT</td>
<td></td>
</tr>
<tr>
<td><strong>1.3 RYG - S'CHA</strong></td>
<td>31.5 FIRS</td>
</tr>
<tr>
<td>- MDO = 346.50 Lts @ 11.60 BAHT = 4,019.40 BAHT</td>
<td></td>
</tr>
<tr>
<td>- FO 180 = 4,095.00 Lts @ 8.78 BAHT = 35,954.10 BAHT</td>
<td></td>
</tr>
<tr>
<td>- LO = 10.00 Lts @ 30.20 BAHT = 302.00 BAHT</td>
<td></td>
</tr>
<tr>
<td>- CY = 10.00 Lts @ 32.50 BAHT = 325.00 BAHT</td>
<td></td>
</tr>
<tr>
<td><strong>1.4 RYG - PNG - BDN</strong></td>
<td>120 HRS</td>
</tr>
<tr>
<td>- MDO = 1,320.00 Lts @ 11.60 BAHT = 15,312.00 BAHT</td>
<td></td>
</tr>
<tr>
<td>- FO 180 = 15,600.00 Lts @ 8.78 BAHT = 136,968.00 BAHT</td>
<td></td>
</tr>
<tr>
<td>- LO = 10.00 Lts @ 30.20 BAHT = 302.00 BAHT</td>
<td></td>
</tr>
<tr>
<td>- CY = 65.00 Lts @ 32.50 BAHT = 2,112.50 BAHT</td>
<td></td>
</tr>
<tr>
<td><strong>1.5 RYG - SKA</strong></td>
<td>120 HRS</td>
</tr>
<tr>
<td>- MDO = 1,320.00 Lts @ 11.60 BAHT = 15,312.00 BAHT</td>
<td></td>
</tr>
<tr>
<td>- FO 180 = 15,600.00 Lts @ 8.78 BAHT = 136,968.00 BAHT</td>
<td></td>
</tr>
<tr>
<td>- LO = 10.00 Lts @ 30.20 BAHT = 302.00 BAHT</td>
<td></td>
</tr>
<tr>
<td>- CY = 65.00 Lts @ 32.50 BAHT = 2,112.50 BAHT</td>
<td></td>
</tr>
<tr>
<td><strong>1.6 RYG - PKE - S'PORE - BKK</strong></td>
<td>330 FIRS</td>
</tr>
<tr>
<td>- MDO = 3,630.00 Lts @ 6.2 BAHT = 22,506.00 BAHT</td>
<td></td>
</tr>
<tr>
<td>- FO 180 = 42,900.00 Lts @ 6.2 BAHT = 265,980.00 BAHT</td>
<td></td>
</tr>
<tr>
<td>- LO = 75.00 Lts @ 30.20 BAHT = 2,265.00 BAHT</td>
<td></td>
</tr>
<tr>
<td>- CY = 245.00 Lts @ 32.50 BAHT = 7,962.50 BAHT</td>
<td></td>
</tr>
</tbody>
</table>

58
Table 4.1. Structure of Cost (Continued).

### 2 PORT CHARGE

<table>
<thead>
<tr>
<th>Route</th>
<th>Expenses for Loading Port</th>
<th>Expenses for DSG Port</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.2.1 RYG - PKT</td>
<td>18,600.00 BAHT</td>
<td>27,760.00 BAHT</td>
<td>46,360.00 BAHT</td>
</tr>
<tr>
<td>1.2.2 RYG - BKK</td>
<td>17,000.00 BAHT</td>
<td>22,500.00 BAHT</td>
<td>43,400.00 BAHT</td>
</tr>
<tr>
<td>1.2.3 RYG - SCHA</td>
<td>17,000.00 BAHT</td>
<td>3,000.00 BAHT</td>
<td>43,400.00 BAHT</td>
</tr>
<tr>
<td>1.2.4 RYG - PNG - BDN</td>
<td>17,000.00 BAHT</td>
<td>6,000.00 BAHT</td>
<td>43,400.00 BAHT</td>
</tr>
<tr>
<td>1.2.5 RYG - SKA</td>
<td>17,000.00 BAHT</td>
<td>17,200.00 BAHT</td>
<td>43,400.00 BAHT</td>
</tr>
<tr>
<td>1.2.6 RYG - PKE - S'PORE - BKK</td>
<td>18,600.00 BAHT</td>
<td>27,760.00 BAHT</td>
<td>43,400.00 BAHT</td>
</tr>
</tbody>
</table>

### 3 CARGO INSURANCE

<table>
<thead>
<tr>
<th>Route</th>
<th>Insurance Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1 RYG - PKT</td>
<td>2,500.00 BAHTNOY</td>
</tr>
<tr>
<td>3.2 RYG - BKK</td>
<td>2,200.00 BAHTNOY</td>
</tr>
<tr>
<td>3.3 RYG - SCHA</td>
<td>2,200.00 BAHTNOY</td>
</tr>
<tr>
<td>3.4 RYG - PNG - BDN</td>
<td>2,500.00 BAHTNOY</td>
</tr>
<tr>
<td>3.5 RYG - SKA</td>
<td>2,500.00 BAHTNOY</td>
</tr>
<tr>
<td>3.6 RYG - PKE - S'PORE - BKK</td>
<td>2,500.00 BAHTNOY</td>
</tr>
</tbody>
</table>

### 4 MISCELLANEOUS

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voyage Expenses</td>
<td>8,000.00 BAHT/MONTH</td>
</tr>
<tr>
<td>Utilities</td>
<td>38,000.00 BAHT/MONTH</td>
</tr>
<tr>
<td>Consumption (ADM)</td>
<td>3,000.00 BAHT/MONTH</td>
</tr>
<tr>
<td>Food &amp; Drink</td>
<td>2,000.00 BAHT/MONTH</td>
</tr>
<tr>
<td></td>
<td>51,000.00 BAHT/MONTH</td>
</tr>
</tbody>
</table>

Total: 24,200 BAHT
## Fix Costs and Variable Costs

<table>
<thead>
<tr>
<th>YEAR</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NUMBER OF MONTHS (CAN OPERATE)</strong></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
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### Table Rows:
- **YEAR** column: Represents the year for which the costs are calculated.
- **NUMBER OF MONTHS (CAN OPERATE)** column: Indicates the number of months the operation can run.
- **FIX COST TOTAL** and **VARIABLE COSTS TOTAL** rows: Summarize the total fixed and variable costs respectively.
- **Variable Cost** rows: Detail the costs for each category of variable expenses.
- **GRAND TOTAL** row: The overall total of all fixed and variable costs combined.
## Cash Flow 10 Years

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**Net Orders:**

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**Due Cash:**

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### Project & Loss of 10 Years Planning Project

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### Notes

- AS: C-10
- TC N N: C-2
- PART 1: C-3
- VAC N EU: C-4
- CR: C-5
- VIGEAS: C-6

### Additional Information

- T. CO: 10
- N - CO: 20
### Internal Rate of Return

#### Cash Inflow

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- Net Cash Flow (100%)
- Residual Value
- Total Cash Inflow

#### Cash Outflow

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- Investment
- Total Cash Outflow

#### Net Cashflow for IRR

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- IRR = (10 years)
- IRR = (8 years)
### Payback Period

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<td>2.78</td>
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### Net Profit and Loss of Project

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</tbody>
</table>
| Net profit + Depre. | -9 | 24.80 | 18.27 | 28.01 | 17.54 | 28 | 8.81 | 17.31 | 17.84 | 11.15%
| Net profit - Investment | 2 | -46.8 | -63.21 | -2 | -107.17 | -138.5 | -173.7 | -177.48 | -195.35 | -206.90
| Average Net Profit / Month | 1.79 | 2.07 | 1.42 | 2.17 | 1.60 | 2.22 | 2.19 | 1.44 | 1.49 | 0.96 |
5.1 Overview of Project Implementation

After management have approved the proposed system, the ASVCS DBMS is implemented. The implementation consists of the installation of the new system which involves software and hardware installation, reporting, data conversion and transfer, testing, presentation, reviewing, and training. The system will be implemented during August and September.

During implementation of the system, problems may occur and solutions usually require modification of the design. It should be noted that before a software application is designed for the new system, software development fundamentals and user responses should be investigated. The reason this project is designed to use Microsoft Access as a developing tool is that the software is available and has a graphical user interface.

The development of application used in the system falls into three stages, which are the programming, testing and production. The first stage is developing the program applications to serve business function needs. Testing is an important process before implementing applications. It helps identify errors in the program. Furthermore, it shows what is needed. Each module is tested to ensure it works. Test data is created and input to the system, then the program is run in order to test all possible situations that may occur.
5.2 Implementation

The Analysis of a Sea Vessels Costing System (ASVCS) is a computerized database system for work, analysis, and control of a budget plan of Business Development Division.

ASVCS is created with the objective of centralizing and managing on budgeting system on a PC system. By being separate from the existing LAN system, the ASVCS can import raw data in order to computerize conveniently and more effectively. Since the current procedure separates people working on different pieces of data, it is very difficult and time-consuming to collect all the costing information. Management cannot gather data on time, thus the decision making is delayed. Concurrently, the current LAN system is a high-performance base which needs time and experienced programmers to be utilized effectively, thus creating inflexibility.

There is some historical data to be kept in the system, so this data must be converted to a Microsoft Access Database using an import function. Then, the correctness of the data must be investigated, and it must be formatted to suit the program requires. User training follows installation of the software. There are three groups of users: operators who update and input data, manager and supervisors who manage information, and system administration who will administer the application.

In the future if the vessels has the equipment to communicate with the shore we may use the real time cost to make the decision with the ASVCS too.

We can use this program to adapt and work integrate with other accounting programs like SAP, ACCPAC, because we can migrate the costing data on real time to ASVCS to calculate and find the decision making of Finance Statements.

The program can help the seaman and the office to plan the budget and control it and help the board of committee to see the global picture of the sea vessels scope.
customers, equipment, and contractors are changing, however the model can handle all changes effectively. Management will make decisions following the data analysis from modified reports in the program.

6.2 Conclusions

With the new process of requesting all costing from each department, Controllers, Planning & Investment, Project manager, customers and contractors/suppliers, BD will be the party who records data in the system. ASVCS DBMS is developed to serve needs related to recording maintenance & repair services for all equipment, and petroleum products handling equipment. ASVCS DBMS could help centralize all information. The system is a tool to control operating cost and capital budget spending in the organization. The system also reduces and simplifies redundant or unnecessary work in the ASVCS DBMS process, including effective security procedures ensures confidence about information leakage and security.

The interesting features of the system are that it can decrease the work time required for user to perform their tasks and also control documentation in the computing system. The system also provides the ability to keep track of all records that are important in marketing work and support functions.

The cost will be less than existing system even if manpower cost, office costs and electrical costs are included. So, the system shows a positive cost/benefit result. The interfaces and reports were developed according to user requirements and use the same interface for every screen, so users can get familiar with the system easily.
6.3 Recommendation

The system provides computerized support for immediate requirements. The system also supports more automated functions such as providing an interface between cost information and ASVCS special programs. This extension is created to serve more for the users. However, there are some opportunities for the system to be extended to serve the future needs as follows:

(a) Connecting with relevant users in the upcountry regions using direct modem connection.

(b) Creating of work orders and work requests for ASVCS operations that record all detailed work in the ASVCS.

(c) Creating another format extension i.e. PDA etc.

The implementation of these expected extensions would depend on applicability and cost effectiveness, with the expectation that the system will lead to the competitive advantages to improve work efficiency for the company.
The benefits from ASVCS are claimed to include:

(a) lower accounting and record keeping costs
(b) lower transportation costs
(c) lower investment in equipment
(d) lower investment in other software
(e) lower investment in labor
(f) reduced calculation down-times
(g) more flexible decided processes
(h) more efficient lot sizes and scheduling
(i) reduced errors due to poor co-ordination
(j) the cost and efficiency improvements (mentioned above) could increase profitability or increase market share (at a lower price)
(k) reduced number of stock-outs
(l) reduced fulfillment times
(m) increase process transparency for the customer

The limitations and pitfalls of the ASVCS are:

(a) the systems can be very expensive to install and maintain
(b) some systems can be difficult to use
(c) the system is no better than the weakest link in the chain - a problem in one department or at one of the partners will affect all the other participants
(d) once a system is established, switching costs are very high for any one of the partners (reduced flexibility and strategic control at the corporate level)
(e) the blurring of company boundaries can cause problems in accountability, lines of responsibility, and employee morale

(f) there is a resistance to sharing sensitive internal information, information that may be essential to the process

(g) there are compatibility problems with the various legacies.
APPENDIX A

DATA FLOW DIAGRAM OF THE PROPOSED SYSTEM
Figure A.1. Data Flow Diagram.
Figure A.2. Level 0.
1.1 Operation Cost
   - Receive and Transform
   - Vessel Requisition

1.2 Vessel Requisition
   - Check Price with Suppliers
   - Quotation

1.3 Costing
   - Approve and Send to Vessel

1.4 SOP Data
   - Date SOP File

Figure A.3: Level 1-1.
Figure A.4. Level 1-2.

Figure A.5. Level 1-3.

78
Cost Information

Separate Costing 1

Evaluate Costing Profit & Loss Data with Contract Revenue

Costing Data

Evaluate Cash Flow Information

Evaluate IRR and TEP

Cost Information

Separate Costing 2

Costing Data

Evaluate Costing Profit & Loss

Separate Costing 3

Costing Data

Separate Costing 4

Costing Data

Separate Costing 5

Costing Data

Separate Costing 6

Cost Information

Alt Department Costing

Figure A.9. Level 1-7.
Figure A.10. Level 1-8.
Table B.1. Master.

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Type of Data</th>
<th>Size</th>
<th>Example of Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID</td>
<td>Autonumber</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project Name</td>
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<td>Flag</td>
<td>Text</td>
<td>20</td>
<td>Xx...20</td>
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<tr>
<td>End Project</td>
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<td>Price</td>
<td>Currency</td>
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</tbody>
</table>

Table B.2. Import-Cost-ACC.

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Type of Data</th>
<th>Size</th>
<th>Example of Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID</td>
<td>Autonumber</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type</td>
<td>Autonumber</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost Detail</td>
<td>Text</td>
<td>20</td>
<td>Xx...20</td>
</tr>
</tbody>
</table>

Table B.3. Import-Cost-SOP.

<table>
<thead>
<tr>
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<th>Type of Data</th>
<th>Size</th>
<th>Example of Data</th>
</tr>
</thead>
<tbody>
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<tr>
<td>Type</td>
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<tr>
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<td>Text</td>
<td>20</td>
<td>Xx...20</td>
</tr>
</tbody>
</table>

Table B.4. Import-Cost-ADM.

<table>
<thead>
<tr>
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<th>Type of Data</th>
<th>Size</th>
<th>Example of Data</th>
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</thead>
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<tr>
<td>Type</td>
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Table B.5.  Import-Cost-CRW.

<table>
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Table B.6.  Import-Cost-ENG.

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<th>Size</th>
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Table B.7.  Cost-Categories.

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<th>Size</th>
<th>Example of Data</th>
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<tr>
<td>Type</td>
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<td>Xx...50</td>
</tr>
</tbody>
</table>
Relationships Between Tables in The System

Master — Import-Cost-ACC

```
+----------------+------------------+
| TBMaster       | TBImport-Cost-Acc|
| ID             | ID               |
+----------------+------------------+
```

Attributes: Not Enforced
Attributes: One — to - many

Master — Import-Cost-SOP

```
+----------------+------------------+
| TBMaster       | TBImport-Cost-Sop|
| ID             | ID               |
+----------------+------------------+
```

Attributes: Not Enforced
Attributes: One — to - many

Master-Import-Cost-ADM

```
+----------------+------------------+
| TBMaster       | TBImport-Cost-Adm|
| ID             | ID               |
+----------------+------------------+
```

Attributes: Not Enforced
Attributes: One — to - many

Master — Import-Cost-CRW

```
+----------------+------------------+
| TBMaster       | TBImport-Cost-Crw|
| ID             | ID               |
+----------------+------------------+
```

Attributes: Not Enforced
Attributes: One — to - many
### Master — Import-Cost-ENG

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</thead>
<tbody>
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</table>

Attributes: Not Enforced
Attributes: One — to - many

### Cost-Categories to Import-Cost-ACC

<table>
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<tr>
<th>1BCost-Categories</th>
<th>1</th>
<th>TBImport-Cost-Acc</th>
</tr>
</thead>
<tbody>
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<td>TYPE</td>
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</table>

Attributes: Not Enforced
Attributes: One — to - many

### Cost-Categories to Import-Cost-Sop

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</thead>
<tbody>
<tr>
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<td>TYPE</td>
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</table>

Attributes: Not Enforced
Attributes: One — to - many

### Cost-Categories to Import-Cost-ADM

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</table>

Attributes: Not Enforced
Attributes: One — to - many

85
### Cost-Categories to Import-Cost-CRW

<table>
<thead>
<tr>
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<th>m TBlImport-Cost-Crw</th>
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</thead>
<tbody>
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<td>TYPE</td>
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</table>

Attributes: Noi Enforced
Attributes: One — to - many

### Cost-Categories to Import-Cost-ENG

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</thead>
<tbody>
<tr>
<td>TYPE</td>
<td>TYPE</td>
</tr>
</tbody>
</table>

Attributes: Not Enforced
Attributes: One — to - many
APPENDIX C

DETAIL OF DATA FLOW DIAGRAM
Recieve and Transform Vessel Repair & Maintenance Process

Process #: 3.1

Location:

Level - 1-3 (3)

Input Flows:
Maintenance Cost

Output Flows:
Repair and Maintenance Detail

Date Last Altered: 17/07/2003  Date Created: 17/07/2003

Recieve and Transform Vessel Requisition Process

Process #: 1.1

Location:

Level - 1-1 (1)

Input Flows:
Operation Cost

Output Flows:
Vessel Requisition

Date Last Altered: 17/07/2003  Date Created: 17/07/2003

Recieve Survey Recommend Form Process

Process #: 2.1

Location:

Level - 1-2 (2)

Input Flows:
Auditing Cost
Vessel Requisition

Output Flows:
Vessel Requisition

Date Last Altered: 17/07/2003  Date Created: 17/07/2003

Repair and Maintenance Detail Data Flow

Location:

Level - 1-3 (3)
Quality Management Department

Location:

Context (CONTEXT)
Output Flows:
Auditing Cost

Date Last Altered: 27/06/2003  
Date Created: 27/06/2003

Quality Management File

Data Store #: D2

Location:

Level 0 (0)
Input Flows:
Quality Data
Output Flows:
Cost Information

Date Last Altered: 17/07/2003  
Date Created: 17/07/2003

Quotation

Location:

Level -1-1 (1)
Source: Check Price with Suppliers (Process)
Dest: Approve and Send to Vessel Process

Date Last Altered: 17/07/2003  
Date Created: 17/07/2003

Receive and Transform Consumption Requisition

Process #: 5.1

Location:

Level -1-5 (5)
Input Flows:
Consumption Cost
Output Flows:
Consumption Detail

Date Last Altered: 17/07/2003  
Date Created: 17/07/2003
Push Data From Query

Process

Process #: 8.2

Location:

Level - 1-8 ( 8 )

Input Flows:
Costing Data

Output Flows:
Costing Data

Quality Control

Process

Process #: 2

Location:

Level 0 ( 0 )

Input Flows:
Auditing Cost

Output Flows:
Quality Data

Quality Data

Data Flow

Location:

Level 0 ( 0 )

Source: Quality Control ( Process )

Dest: Quality Management File ( Data Store )

Level - 1-2 ( 2 )

Source: Update QM File ( Process )

Dest: *** Not on Diagram ***
Operation Cost

Location:

Context (CONJEXT)

Source: Ship Operation Department (External Entity)
Dest: Analysis Vessels Costing System (Process)

Level 0 (0)

Source: ***Not on Diagram***
Dest: Ship Operation Control (Process)

Level - 1-1 (1)

Source: ***Not on Diagram***
Dest: Receive and Transform Vessel Requisition (Process)

Date Last Altered: 27/06/2003
Date Created: 27/06/2003

Price Datail

Location:

Level - 1-5 (5)

Source: Check Price and Negotiate with Suppliers (Process)
Dest: Approve and Send Consumption to Vessel (Process)

Date Last Altered: 17/07/2003
Date Created: 17/07/2003

Project Budget Report

Location:

Context (CONTEXT)

Source: Analysis Vessels Costing System (Process)
Dest: Accounting Department (External Entity)

Level 0 (0)

Source: Generate Report (Process)
Dest: ***Not on Diagram***

Level - 1-8 (8)

Source: Generated Report (Process)
Dest: ***Not on Diagram***
Maintenance Control

Process #: 3

Location:

Level 0 (0)

Input Flows:
- Maintenance Cost

Output Flows:
- Maintenance Data

Maintenance Cost

Location:

Context (CONTEXT)

Source: Engineering Department (External Entity)
Dest: Analysis Vessels Costing System (Process)

Level 0 (0)

Source: *** Not on Diagram ***
Dest: Maintenance Control (Process)

Level -1-3 (3)

Source: *** Not on Diagram ***
Dest: *** Not on Diagram ***

Maintenance Data

Location:

Level 0 (0)

Source: Maintenance Control (Process)
Dest: Maintenance File (Data Store)

Level -1-3 (3)

Source: Update Engineering Files (Process)
Dest: *** Not on Diagram ***
Information

Data Flow

Location:

Level - 1-7 (7)

Source: Evaluate Profit & Loss with Contract Revenue (Process)
Dest: Evaluate Cash Flow (Process)

Source: Evaluate Cash Flow (Process)
Dest: Evaluate IRR and BEP (Process)

Inquiry

Data Flow

Location:

Level - 1-2 (2)

Source: Check price with supplier (Process)
Dest: Negotiate and Approve (Process)

Instrument specification

Data Flow

Location:

Level - 1-2 (2)

Source: Check Equipment with world Standard (Process)
Dest: Check price with supplier (Process)

Job Data

Data Flow

Location:

Level - 1-3 (3)

Source: Check Price of Job and Decision (Process)
Dest: Send Job order to Internal mechanics (Process)

Source: Check Price of Job and Decision (Process)
Dest: Send Job order to External mechanics (Process)
General Ledger Estimate

Process

Process #: 6.1

Location:

Level - 1-6 (6)

Input Flows:
Budget Report

Output Flows:
Costing Data

Generate Report

Process

Process #: 8

Location:

Level 0 (0)

Input Flows:
Costing Data

Output Flows:
Analyzed Project Report
Management Reports
Project Budget Report

Generated Report

Process

Process #: 8.3

Location:

Level - 1-8 (8)

Input Flows:
Costing Data

Output Flows:
Analyzed Project Report
Management Reports
Project Budget Report
**Output Flows:**

Information

---

**Date Last Altered:** 17/07/2003  
**Date Created:** 17/07/2003

Evaluate information

**Process**

**Process #:** 7

**Location:**

Level 0 ( 0 )

**Input Flows:**

- Cost Information
- Cost Information
- Cost Information
- Cost Information
- Cost Information
- Cost Information

**Output Flows:**

All Department Costing

---

**Date Last Altered:** 17/07/2003  
**Date Created:** 17/07/2003

Evaluate IRR and BEP

**Process**

**Process #:** 7.9

**Location:**

Level - 1-7 ( 7 )

**Input Flows:**

- Information

**Output Flows:**

All Department Costing

---

**Date Last Altered:** 17/07/2003  
**Date Created:** 17/07/2003

Evaluate Profit & Loss with Contract Revenue

**Process**

**Process #:** 7.7

**Location:**

Level - 1-7 ( 7 )

**Input Flows:**

- Costing Data
- Costing Data
- Costing Data
- Costing Data

---

95
Source: Compensation Control (Process)
Dest: ***Not on Diagram***

Date Last Altered: 17/07/2003  Date Created: 17/07/2003

Crew Department

Location:

Context (CONTEXT)
Output Flows:
Salary and Wages Cost

Date Last Altered: 27/06/2003  Date Created: 27/06/2003

Crew File

Data Store #: D4

Location:

Level 0 (0)
Input Flows:
Crew Data
Output Flows:
Cost Information

Date Last Altered: 17/07/2003  Date Created: 17/07/2003

Engineering Department

Location:

Context (CONTEXT)
Output Flows:
Maintenance Cost

Date Last Altered: 27/06/2003  Date Created: 27/06/2003

Evaluate Cash Flow

Process #: 7.8

Location:

Level - 1-7 (7)
Input Flows:
Information
Level - 1-6 (6)

Source: General Ledger Estimate (Process)
Dest: Compare with Actual Cost (Process)

Level 0 (0)

Source: Business Development File (Data Store)
Dest: Generate Report (Process)

Level - 1-7 (7)

Source: Separate Costing 1 (Process)
Dest: Evaluate Profit & Loss with Contract Revenue (Process)

Source: Separate Costing 2 (Process)
Dest: Evaluate Profit & Loss with Contract Revenue (Process)

Source: Separate Costing 3 (Process)
Dest: Evaluate Profit & Loss with Contract Revenue (Process)

Source: Separate Costing 4 (Process)
Dest: Evaluate Profit & Loss with Contract Revenue (Process)

Source: Separate Costing 5 (Process)
Dest: Evaluate Profit & Loss with Contract Revenue (Process)

Source: Separate Costing 6 (Process)
Dest: Evaluate Profit & Loss with Contract Revenue (Process)

Level - 1-8 (8)

Source: ***Not on Diagram***
Dest: Authorize User Control (Process)

Source: Authorize User Control (Process)
Dest: Push Data From Query (Process)

Source: Push Data From Query (Process)
Dest: Generated Report (Process)

Date Last Altered: 17/07/2003
Date Created: 17/07/2003

Crew Data

Location:

Level 0 (0)

Source: Salary and Wages Control (Process)
Dest: Crew File (Data Store)

Level - 1-4 (4)
Source: **Not on Diagram***
Dest: Separate Costing 4 (Process)

Source: **Not on Diagram***
Dest: Separate Costing 6 (Process)

Source: **Not on Diagram***
Dest: Separate Costing 5 (Process)

Date Last Altered: 17/07/2003
Date Created: 17/07/2003

---

Costing Data Flow

Location:

Level - 1-1 (1)
Source: Approve and Send to Vessel (Process)
Dest: Update SOP File (Process)

Level - 1-2 (2)
Source: Check price with supplier (Process)
Dest: Check Equipment with world Standard (Process)

Date Last Altered: 17/07/2003
Date Created: 17/07/2003

---

Costing Data Flow

Location:

Level - 1-2 (2)
Source: Negotiate and Approve (Process)
Dest: Update QM File (Process)

Level - 1-3 (3)
Source: Sumary Cost and Jobs (Process)
Dest: Update Engineering Files (Process)

Source: Send Job order to Internal mechanics (Process)
Dest: Sumary Cost and Jobs (Process)

Source: Send Job order to External mechanics (Process)
Dest: Sumary Cost and Jobs (Process)

Level - 1-5 (5)
Source: Approve and Send Consumption to Vessel (Process)
Dest: Update ADM File (Process)
Consumption Detail

**Data Flow**

**Location:**

**Level - 1-5 ( 5 )**

*Source:* Recieve and Transform Consumption Requisition ( Process )
*Dest:* Check Price and Negociate with Suppliers ( Process )

**Date Last Altered:** 27/06/2003  
**Date Created:** 27/06/2003

Cost Information

**Data Flow**

**Location:**

**Level 0 ( 0 )**

*Source:* Ship Operation File ( Data Store )  
*Dest:* Evaluate Information ( Process )

*Source:* Quality Management File ( Data Store )  
*Dest:* Evaluate Information ( Process )

*Source:* Maintenance File ( Data Store )  
*Dest:* Evaluate Information ( Process )

*Source:* Crew File ( Data Store )  
*Dest:* Evaluate Information ( Process )

*Source:* Admin File ( Data Store )  
*Dest:* Evaluate Information ( Process )

*Source:* Accountant File ( Data Store )  
*Dest:* Evaluate Information ( Process )

**Level - 1-7 ( 7 )**

*Source:* ***Not on Diagram***  
*Dest:* Separate Costing 1 ( Process )

*Source:* ***Not on Diagram***  
*Dest:* Separate Costing 2 ( Process )

*Source:* ***Not on Diagram***  
*Dest:* Separate Costing 3 ( Process )
**Output Flows:**
- Account Data

**Date Last Altered:** 17/07/2003  
**Date Created:** 17/07/2003

**Compensation Control**
- **Process #:** 4.2
- **Location:**
  - Level - 1-4 (4)
- **Input Flows:**
  - Wages Data
- **Output Flows:**
  - Crew Data

**Date Last Altered:** 17/07/2003  
**Date Created:** 17/07/2003

**Consumption Control**
- **Process #:** 5
- **Location:**
  - Level 0 (0)
- **Input Flows:**
  - Consumption Cost
- **Output Flows:**
  - Admin Data

**Date Last Altered:** 17/07/2003  
**Date Created:** 17/07/2003

**Consumption Cost**
- **Data Flow**
- **Location:**
  - Context (CONTEXT)
  - Source:
    - Administration Department (External Entity)
    - Analysis Vessels Costing System (Process)
  - Level 0 (0)
  - Source: ***Not on Diagram***
  - Dest: Consumption Control (Process)

**Level - 1-5 (5)**
Check price with supplier

Process

Process #: 2.3

Location:

Level - 1-2 (2)

Input Flows:
Instrument specification

Output Flows:
Inquiry
Costing

Date Last Altered: 17/07/2003
Date Created: 17/07/2003

Check Price with Suppliers

Process

Process #: 1.2

Location:

Level - 1-1 (1)

Input Flows:
Vessel Requisition

Output Flows:
Quotation

Date Last Altered: 17/07/2003
Date Created: 17/07/2003

Compare with Actual Cost

Process

Process #: 6.2

Location:

Level - 1-6 (6)

Input Flows:
Costing, Data
Business Development File  

Data Store

Data Store #: D8

Location:

Level 0 (0)

Input Flows:
- All Department Costing

Output Flows:
- Costing Data

Date Last Altered: 17/07/2003  
Date Created: 17/07/2003

Check Equipment with World Standard Process

Process #: 2.2

Location:

Level - 1-2 (2)

Input Flows:
- Vessel Requisition
- Costing

Output Flows:
- Instrument specification
- Vessel Requisition

Date Last Altered: 17/07/2003  
Date Created: 17/07/2003

Check Price and Negotiate with Suppliers Process

Process #: 5.2

Location:

Level - 1-5 (5)

Input Flows:
- Consumption Detail

Output Flows:
- Price Datail

Date Last Altered: 17/07/2003  
Date Created: 17/07/2003

Check Price of Job and Decision Process

Process #: 3.2
Output Flows:
Costing Data

Date Last Altered: 17/07/2003   Date Created: 17/07/2003

Bank and BOI

Location:

Context (CONTEXT)

Input Flows:
Analyzed Project Report

Date Last Altered: 27/06/2003   Date Created: 27/06/2003

Budget Control

Process #. 6

Location:

Level 0 (0)

Input Flows:
Budget Report

Output Flows:
Account Data

Date Last Altered: 17/07/2003   Date Created: 17/07/2003

Budget Report

Data Flow

Location:

Context (CONTEXT)

Source: Accounting Department (External Entity)
Dest: Analysis Vessels Costing System (Process)

Level 0 (0)

Source: ***Not on Diagram***
Dest: Budget Control (Process)

Level - 1-6 (6)

Source: ***Not on Diagram***
Dest: General Ledger Estimate (Process)

Date Last Altered: 27/06/2003   Date Created: 27/06/2003
Output Flows:
Costing Data

Date Last Altered: 17/07/2003  Date Created: 17/07/2003

Approve and Send to Vessel Process

Process #: 1.3

Location:
Level - 1-1 ( 1 )
Input Flows:
Quotation
Output Flows:
Costing

Date Last Altered: 17/07/2003  Date Created: 17/07/2003

Auditing Cost Data Flow

Location:
Context ( CONTEXT )
Source: Quality Management Department ( External Entity )
Dest: Analysis Vessels Costing System ( Process )
Level 0 ( 0 )
Source: *** Not on Diagram ***
Dest: Quality Control ( Process )
Level - 1-2 ( 2 )
Source: *** Not on Diagram ***
Dest: Recieve Survey Recomend Form ( Process )

Date Last Altered: 27/06/2003  Date Created: 27/06/2003

Authorize User Control Process

Process #: 8.1

Location:
Level - 1-8 ( 8 )
Input Flows:
Costing Data
Location:

Context (CONTEXT)

Source: Analysis Vessels Costing System (Process)
Dest: Bank and BOI (External Entity)

Level 0 (0)

Source: Generate Report (Process)
Dest: ***Not on Diagram***

Level - 1-8 (8)

Source: Generated Report (Process)
Dest: ***Not on Diagram***

Date Last Altered: 27/06/2003  Date Created: 27/06/2003

Analysis Vessels Costing System  Process

Process #: 0

Location:

Context (CONTEXT)

Input Flows:
- Operation Cost
- Auditing Cost
- Maintenance Cost
- Salary and Wages Cost
- Consumption Cost
- Budget Report

Output Flows:
- Analyed Project Report
- Management Reports
- Project Budget Report

Date Last Altered: 27/06/2003  Date Created: 27/06/2003

Approve and Send Consumption to Vessel  Process

Process #: 5.3

Location:

Level - 1-5 (5)

Input Flows:
- Price Datail
Level - 1-5 ( 5 )

Source: Update ADM File ( Process )
Dest: ***Not on Diagram ***

Date Last Altered: 17/07/2003  Date Created: 17/07/2003

Admin File

Data Store #: D5

Location:

Level 0 ( 0 )
Input Flows:
Admin Data
Output Flows:
Cost Information

Date Last Altered: 17/07/2003  Date Created: 17/07/2003

Administration Department

External Entity

Location:

Context ( CONTEXT )
Output Flows:
Consumption Cost

Date Last Altered: 27/06/2003  Date Created: 27/06/2003

All Department Costing

Data Flow

Location:

Level 0 ( 0 )
Source: Evaluate Information ( Process )
Dest: Business Development File ( Data Store )

Level t 1-7 ( 7 )

Source: Evaluate IRR and BEP ( Process )
Dest: *** Not on Diagram ***

Date Last Altered: 17/07/2003  Date Created: 17/07/2003
Account Data

Location:

Level 0 ( 0 )

Source: Budget Control ( Process )
Dest: Accountant File ( Data Store )

Level - 1-6 ( 6 )

Source: Compare with Actual Cost ( Process )
Dest: *** Not on Diagram ***

Date Last Altered: 17/07/2003
Date Created: 17/07/2003

Accountant File

Data Store

Data Store #: D6

Location:

Level 0 ( 0 )

Input Flows:
Account Data

Output Flows:
Cost Information

Date Last Altered: 17/07/2003
Date Created: 17/07/2003

Date Last Altered: 17/07/2003
Date Created: 17/07/2003

Accounting Department

External Entity

Location:

Context ( CONTEXT )

Input Flows:
Project Budget Report

Output Flows:
Budget Report

Date Last Altered: 27/06/2003
Date Created: 27/06/2003

Admin Data

Data Flow

Location:

Level 0 ( 0 )

Source: Consumption Control ( Process )
Dest: Admin File ( Data Store )

Date Last Altered: 17/07/2003
Date Created: 17/07/2003

Date Last Altered: 17/07/2003
Date Created: 17/07/2003

Date Last Altered: 27/06/2003
Date Created: 27/06/2003

Date Last Altered: 17/07/2003
Date Created: 17/07/2003

Date Last Altered: 17/07/2003
Date Created: 17/07/2003

Date Last Altered: 27/06/2003
Date Created: 27/06/2003
Update SOP File

Process

Process #: 1.4

Location:

Level - 1-1 (1)

Input Flows:
Costing

Output Flows:
SOP Data

Vessel Requisition

Data Flow

Location:

Level - 1-1 (1)

Source:
Receive and Transform Vessel Requisition (Process)

Dest:
Check Price with Suppliers (Process)

Level - 1-2 (2)

Source:
Receive Survey Recommend Form (Process)

Dest:
Check Equipment with world Standard (Process)

Source:
Check Equipment with world Standard (Process)

Dest:
Receive Survey Recommend Form (Process)

Wages Data

Data Flow

Location:

Level - 1-4 (4)

Source:
Salary and Wages Policy (Process)

Dest:
Compensation Control (Process)
Update ADM File

Process #: 5.4

Location:

Level - 1-5 (5)
Input Flows:
Costing Data
Output Flows:
Admin Data

Date Last Altered: 17/07/2003
Date Created: 17/07/2003

Update Engineering Files

Process #: 3.6

Location:

Level - 1-3 (3)
Input Flows:
Costing Data
Output Flows:
Maintenance Data

Date Last Altered: 17/07/2003
Date Created: 17/07/2003

Update QM File

Process #: 2.5

Location:

Level - 1-2 (2)
Input Flows:
Costing Data
Output Flows:
Quality Data
Ship Operation File

Data Store

Data Store #: D7

Location:

Level 0 (0)

Input Flows:
SOP Data,

Output Flows:
Cost Information

Date Last Altered: 17/07/2003  Date Created: 17/07/2003

SOP Data

Location:

Level 0 (0)

Source: Ship Operation Control (Process)
Dest: Ship Operation File (Data Store)

Level - 1-1 (1)

Source: Update SOP File (Process)
Dest: *** Not on Diagram ***

Date Last Altered: 17/07/2003  Date Created: 17/07/2003

Sumary Cost and Jobs

Process

Process #: 3.5

Location:

Level - 1-3 (3)

Input Flows:
Costing Data
Costing Data

Output Flows:
Costing Data

Date Last Altered: 17/07/2003  Date Created: 17/07/2003
Separate Costing 2

**Process**

*Process #*: 7.2

*Location:*

Level - 1-7 (7)

*Input Flows:*
Cost Information

*Output Flows:*
Costing Data

*Date Last Altered:* 17/07/2003  
*Date Created:* 17/07/2003

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Separate Costing 3

**Process**

*Process #*: 7.3

*Location:*

Level - 1-7 (7)

*Input Flows:*
Cost Information

*Output Flows:*
Costing Data

*Date Last Altered:* 17/07/2003  
*Date Created:* 17/07/2003

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Separate Costing 4

**Process**

*Process #*: 7.4

*Location:*

Level - 1-7 (7)

*Input Flows:*
Cost Information

*Output Flows:*
Costing Data

*Date Last Altered:* 17/07/2003  
*Date Created:* 17/07/2003

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Separate Costing 5

**Process**

*Process #*: 7.5

*Location:*

Level - 1-7 (7)
Send Job order to External mechanics

Process

Process #: 3.4

Location:

Level - 1-3 (3)

Input Flows:
Job Data

Output Flows:
Costing Data

Send Job order to Internal mechanics

Process

Process #: 3.3

Location:

Level - 1-3 (3)

Input Flows:
Job Data

Output Flows:
Costing Data

Separate Costing 1

Process

Process #: 7.1

Location:

Level - 1-7 (7)

Input Flows:
Cost Information

Output Flows:
Costing Data
Salary and Wages Control Process

Process #: 4

Location:

Level 0 (0)

Input Flows:
Salary and Wages Cost

Output Flows:
Crew Data

Salary and Wages Cost Data Flow

Location:

Context (CONTEXT)

Source: Crew Department (External Entity)
Dest*: Analysis Vessels Costing System (Process)

Source: *** Not on Diagram ***
Dest: Salary and Wages Control Process

Level - 1-4 (4)

Source: *** Not on Diagram ***
Dest: Salary and Wages Policy (Process)

Salary and Wages Policy Process

Process #: 4.1

Location:

Level - 1-4 (4)

Input Flows:
Salary and Wages Cost
BIBLIOGRAPHY


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