# RADOS INTERNATIONAL CORPORATION

P. O. BOX 830 SAN PEDRO, CALIFORNIA

# QUEEN MARY

## ANALYSIS OF THE PHYSICAL CONDITION

## AND

## COST TO MAINTAIN

# VOLUME III
# COST/ENGINEERING

## *QUEEN MARY*

FOR
THE CITY OF LONG BEACH
AND
THE PORT OF LONG BEACH

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Fort Lauderdale

# Volume III
# COST/ENGINEERING

**PREPARED FOR**
**THE CITY OF LONG BEACH**
**AND**
**THE PORT OF LONG BEACH**

**JULY 1992**

**PREPARED BY**
**RADOS INTERNATIONAL CORPORATION**

**PROJECT NO. 10518**

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# PREFACE

Upon the Queen Mary's arrival to the Port of Long Beach, many feasibility studies were performed to best determine its mode of operation.

As a result of economic projections performed by the City of Long Beach, it was decided to re-classify the Queen Mary as a floating structure thus eliminating maritime trades for conversion and operation of the vessel. Uniform building codes thus became applicable for repair and modifications to the Queen Mary.

At the time the ship was designed and built, it exceeded the stringent codes of maritime classification societies, which for the most part, assumed loads far in excess of land based uniform building codes.

The term "industry standards" as used frequently throughout this report, refers to an accumulation of standards of the Uniform Building Codes, national fire codes, national electric codes, O.S.H.A., and the maritime classification societies such as (ABS) American Bureau of Shipping, Lloyds of London, (USCG) United States Coast Guard, (IMCO) International Maritime Consulting Organization, and (SOLAS) Safety of Life at Sea.

These standards, if applied during the Queen Mary conversion in 1969-71 would have guaranteed the vessel of a standard which was operationally safe, clear of defects, and well kept. These standards which address both commercial and marine building codes, as applied to the Queen Mary, cannot totally satisfy either, as they exist today.

Estimates of the life span of the vessel can not be projected without drydocking the vessel. Effects of electrolysis and plate deterioration can be determined, only by a complete and thorough inspection of the ship out of water.

# Volume III

# QUEEN MARY FINAL REPORT OUTLINE

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*QUEEN MARY*

## VESSEL ANALYSIS

## SUMMARY

# QUEEN MARY
# VESSEL ANALYSIS

## INTRODUCTION

In accordance with the Consulting Services Contract dated April 30, 1992 between the City of Long Beach, a Municipal Corporation acting by and through it's Board of Harbor Commissioners, and Economics Research Associates (ERA), Rados International Corporation (RIC) a Sub-Consultant to ERA, has assumed the responsibility to analyze the present physical condition of the Queen Mary, and perform the following studies:

1) Determine the estimated costs necessary to bring the floating structure up to industry standards.

2) To evaluate the maintenance costs of the floating structure.

3) To determine the projected cost of new use concepts for the floating structure.

The team of Naval Architects and Marine Engineers from RIC, shipchecked & inspected the floating structure for the purpose of determining the condition of the:

a) Hull Structure in respects to the effects of corrosion, fire safety, and asbestos danger.

b) The Mechanical Systems including Air Conditioning, Heating, Sewage, Fire Main, Fresh Water, and Steam.

c) The Electrical System, including Load Centers, Main Distribution Panels, Transformers, Sub Panel, and Wireways.

The intention of this study is to determine the estimated costs necessary to bring the Queen Mary up to industry standards where possible.

As part of accomplishing this task, specifications and drawings of the Queen Mary were researched and evaluated including hull structures, deck compartmentation, machinery piping system and electrical components. Components and areas that were accessible, were inspected. Some significant areas of the ship that were considered as potential problem areas and could have cost impacts to the study were not inspected. Due to their

locations and/or the inability to dismantle parts of the ships structures, such as the teak wood decks that cover steel deck plating; interior wood paneling that covers piping and wiring; material, and areas that contain asbestos, tanks that contain ballast, the underwater portion of the hull structure, and the overhead paneling that encloses firemain and sprinkling piping.


This engineering study will determine and evaluate the estimated costs to repair and maintain the structure and facilities and address new concepts developed by ERA.

Using the technical information provided by the inspection engineers, our estimating department has generated a "Projected Cost Estimate" for needed repairs, modifications, and new use concepts. The purpose of this undertaking is to provide the City and the Port of Long Beach, technical and financial information in order to assist in determining recommendations, regarding the present use and future of the Queen Mary. Projected cost estimates are developed for the following items:

**Item I** Analysis of the Physical Condition of the Queen Mary and Minimum Required Investment to Bring the Complex up to Industry Standards.

**Item II** Minimum Required Investment Cost for Maintenance Operations on the Queen Mary.

**Item III** Evaluation of New Use Concepts developed by Economic Research Associates.

The Projected Cost Estimates (PCE) developed from the investigation of the structures and systems, provides information in a range of costs, because of the inexact nature and inability to precisely identify all unknown costs. It is not possible to accurately estimate from available drawings and specifications, the necessary costs involved. The unavailability of equipment manuals, outdated equipment, and systems maintenance information is factored into the range of costs.

Past marine experiences have proven that retrofits (repairs, modifications and conversions) in areas that are not accessible, and for which engineering drawings are not available, provide uncertainties until actual demolition occurs and uncovers unknown conditions that might exist. These unknowns, more times than not, result in a chain reaction affecting areas and systems usually not considered. These costs have also been factored into the range of costs.

The estimated costs to perform the scope of work outlined in the following sections are presented in two categories:

- Immediate Repairs
- Deferred Repairs

*Immediate repairs* represent work that should be performed at the earliest possible date.

*Deferred repairs* identifies work that should be performed within a period of three (3) to five (5) years.

## SUMMARY

From actual investigations, audio gauge readings, reviews of engineering documents, and of various studies and reports, it is our opinion that the basic hull structure, in spite of some deterioration of the hull plating and rivets since its last drydocking, is adequate to allow for continued operation. The life of the hull plating and adjoining structure cannot be

determined until an underwater inspection and testing is performed on the entire 150,000 square feet of underwater surface area, or until the ship is drydocked to clean, inspect and audio gauge the hull bottom plating.

Additionally, machinery components and piping systems along with electrical equipment and wiring systems that require repairs and/or replacement, are opinioned to be adequately suited to allow for continued operation provided maintenance programs are implemented to prevent further deterioration of these systems. Each successive year the structure and/ or systems are operated, gradually contributes to the overall decline. Even though the ship has been well maintained under the operation of Disney, the previous years of operation were highlighted by a poor maintenance program.

The conclusion of the Report, is based upon the scope of work study outlined in the following sections. The following Projected Cost Estimated (PCE) to upgrade the Queen Mary to Industry Standards, where applicable, are provided.

## FACTORS

A Maintenance Program should be implemented as soon as possible. Many of the recommendations listed herein are required to either keep the ship operating or to bring it up to acceptable quality standards. Following completion of these items, a Preventive Maintenance Program is necessary to keep the Floating Structure from considerable deterioration for an extended period of time.

Because of the volume of work required at so many locations throughout the ship, it is also our opinion that it would be necessary to accomplish that work in a minimum of a Three Year Planned Program. This would reduce the impacts on operations, improve efficiencies in Re-Construction and Management and allow for a more controlled cash flow.

Rados has attempted to provide an accurate statement of the vessels conditions, and accurate "Projected Cost Estimates" (PCE). The enclosed various cost projections are considered budgetary in nature. In some cases, where access to particular structures or systems was limited, educated guesses are provided based upon past experiences in the marine industry. All information and costs provided are predicated upon normal working hours and days. The information contained in this report is believed to be reasonably correct, but not guaranteed, and Rados International Corporation shall not be responsible for any errors, omissions or misrepresentations.

Due to the configuration of the ship, normal techniques of commercial building construction

do not apply. Conversion contractors working in a shipboard environment are usually limited to personnel experienced in the marine industry rather than those in building trades. These maritime shipwrights are accustomed to working in a compartment which is curved in almost every direction, while at the same time, floating and rolling from side-to-side. The normal building construction techniques which utilize plum bobs and carpenter levels, are not acceptable for most of these applications because of the curvature of the decks from shear and camber. This labor factor has been included in the costs to upgrade and maintain the ship.

A particular area of concern is developing costs related to this study, involve the inclusion of material handling costs for repairs, maintenance and remodeling. For any "area" aboard the ship, the transport of materials from the shore to specific locations within the ship, cause significant cost impacts not normally encountered. This logistics problem for the handling of large and heavy materials from shore to ship is difficult because of the necessity of heavy lift crane requirements and the necessity of multiple movements for each item to arrive at its final destination. The difficulties and cost impacts increase significantly as the materials are distributed and transferred throughout various compartments within the ship. Depending upon the location of the work-area, access for large steel plates, structural components, over sized equipment, panelling, carpet and like items is severely limited. Even though some trunk access is available, rail systems and rigging systems need to be installed in each space to transport oversized and heavy objects. The forward trunk space on decks "A", "B" and "R", were decked over during the conversion to create continuous decks and utilize the spaces more effectively. This covering negated the possibility of utilizing this trunk for material distribution. The uptakes in the boiler rooms, the areas from which all machinery and material was removed during the conversion, were recovered and the funnels replaced atop, thereby eliminating the trunks as viable material handling accesses. The aft trunk although more accessible, is limited to specific areas in the stern. Access for material handling through the convention area via double ramp doors is the most direct access for spaces within the convention areas and boiler rooms. Door access into each compartment limits the sizes of materials which can enter a space unless larger openings are created to transit throughout spaces within the ship. Replacing these cut-out openings additionally add to the cost factor of the material-handling phase.

In summary, considerable time and effort has been expended investigating systems aboard the ship, reviewing engineering documents and examining previous studies and reports of the various structures and systems aboard the Queen Mary. The following "Summary Sheet" represents the Projected Cost Estimates as determined for the minimum investment required to:

a). Bring the complex up to industry standards.
b). Provide for a comprehensive maintenance operation.
c). Incorporate new use concepts as developed by ERA.

# HOTEL QUEEN MARY
# VESSEL ANALYSIS

## RADOS INTERNATIONAL CORPORATION
## P.C.E. ESTIMATE

## SUMMARY SHEET

| CATEGORY | DESCRIPTION | TOTAL |
|---|---|---|
| A) | Analysis of the Physical Condition of the Queen Mary and Minimum Required Investment to Bring the Complex Up To Industry Standards | |
| | • Immediate Items | $ 5,987,045.00 |
| | • Deferred Items | $ 21,119,175.00 |
| | TOTAL | $ 27,106,220.00 |
| B) | Minimum Required Investment Cost for Maintenance Operations on the Queen Mary. | $ 4,853,333.00 |
| C) | Evaluation of New Use Concepts as Developed by ERA. | |
| (1) | Nitetime Entertainment Center | $ 4,809,550.00 |
| (2) | Card Parlor Combined With Entertainment Center | $ 4,939,550.00 |
| (3) | Maritime Museum on Shore with Mini-Tour | $ 50,000.00 |

# Volume III
# SECTION II

## *QUEEN MARY*

## VESSEL ANALYSIS

## INTRODUCTION
## TO
## RADOS INTERNATIONAL CORPORATION

# RADOS INTERNATIONAL CORPORATION

Rados International Corporation is a privately held California corporation located in its office building at 1300 South Beacon Street in San Pedro, California overlooking the Los Angeles Harbor.

The corporation, a naval architectural and marine engineering firm is the current organization under the Rados family ownership and management now in its third generation, which has been continually devoted to serving the needs of the marine industry and those of the U.S. and foreign governments. The staff and management of Rados International is dedicated to maintaining the high degree of professional excellence in all operational areas. This standard has become recognized throughout the industry as the hallmark of engineering, design and program management undertaken by Rados International.

The corporation has provided the following activities for both the domestic and international clients:

- Ship and marine structure design and engineering
- Ship and modification design and engineering
- Special ships system design and engineering
- Shipbuilding facilities design and engineering
- Ship Brokerage
- Marine Surveyor services
- Owners resident inspection services
- Scientific and computer analysis of marine structures
- Conceptual studies
- Concept study development
- Technical training in ship and shipboard systems
- Technical consulting service

Our staff of Naval Architects, marine engineers and other professional personnel are thoroughly conversant with the current rules and regulations of American Bureau of Shipping (ABS), Bureau Veritas, Germanischer Lloyds, Det Norske Veritas, U.S. Maritime Administration (MARAD), and Lloyd's Register. We are thoroughly acquainted with U.S. Coast Guard (USCG) regulations, Safety of Life at Sea (SOLAS), and Inter-Governmental Maritime Consulting Organization (IMCO) requirements as they apply to new designs and modifications to existing vessels.

During the past years the Rados Group designed and constructed a number of vessels for the Department of the Navy, Army and Air Force as well as for the commercial industry. Major repairs and modifications were performed on all types of naval and commercial vessels.

Typical programs performed by Rados International Corporation include design engineering and construction supervision for both military and commercial industries including tankers, cargo vessels, oil drilling vessels, ocean mining vessels, pipe laying barges, cable laying vessels, oceanographic vessels, fishing vessels, passenger vessels and fire fighting boats.

Major modification projects include work on aircraft carriers, battleships, cruisers, frigates, destroyers, the HMS Queen Mary, the HMS Queen Elizabeth, the S.S. United States, Princess Cruise Lines, Cunard Cruise Lines, Admiralty Cruise Lines and Automation of Engine Rooms on various ships.

Our services have been performed in over ten different countries of the world.

During the past years, the Rados Corporations have received letters of commendation and awards from the United States Department of the Navy, Branches of the Army and Air Force; Governments of Argentina, Mexico, England, Spain and Italy, and from domestic and foreign shipping corporations for efficiency in design, construction and cost containments.

In 1967, Rados International Corporation was selected over a number of firms in the United States to provide a team of engineers to board the HMS Queen Mary in Southampton, England and travel with the vessel to New York and back to investigate and determine the condition of the vessel, its machinery and equipment. Report of findings were submitted to the City of Long Beach. Rados was subsequently selected as the Naval Architecture and Marine Engineering firm to design and develop detail construction drawings and specifications to convert the HMS Queen Mary a floating structure, into a hotel, convention center, museum, shopping area, restaurants and tour facility.

During the past years, Rados International Corporation has been awarded contracts by the Wrather Corporation and later the Disney Company to perform studies and develop detail construction drawings and provide supervision for repairs, maintenance and modifications to the structure and for new attractions aboard the Queen Mary.

Over the past 25 years, Rados International Corporation has developed its library and files of various specifications, drawings and equipment lists of both the originally designed vessel, modification drawings of her conversion in 1968-71, and subsequent space and equipment modifications undertaken.

# Volume III
# SECTION III

## QUEEN MARY

## VESSEL ANALYSIS

## A HISTORY OF THE QUEEN MARY

# HISTORY OF THE QUEEN MARY PROGRAM

The Queen Mary was designed and constructed by the John Brown Shipyard, Clydebank, Scotland in the year 1936. The original main characteristics of the ship were as follows:

| | | |
|---|---|---|
| Overall Length | 1019.6 | Feet |
| Beam | 118.0 | Feet |
| Draft | 39.4 | Feet |
| Gross Tonnage | 81,23.7 | Tons |

The hull was designed and built in accordance with the Rules and Regulations of British Lloyds (Lloyds of London) for the highest class 100 A1. Future modifications to structural elements of the floating structure have generally conformed to the Uniform Building Code (UBC). Where ship structures are involved the elements have conformed to the Principals of Naval Architecture and Marine Engineering.

The hull structural elements (plates, shapes and rivets) were constructed using mild steel No. 28-32. This material is roughly equivalent to A-36 structural steel with a yield strength of 33 KSI (Kips per square inch). 1 Kip = 0.45 L.T.

The hull plate thickness as designed, ranges from 1.05 inches on the bottom plating, to 1.20 inches on the turn of the bilge, to 1.01 inches at the "A" Deck which forms the strength deck of the Queen Mary. The bow and stern hull plating areas vary from .72 inches to .80 inches in thickness, due to the less bending moment (stress) requirements for the hull structure. These plate thicknesses far exceed the requirements set forth by the strict Lloyd's Register of Shipping Classification Society.

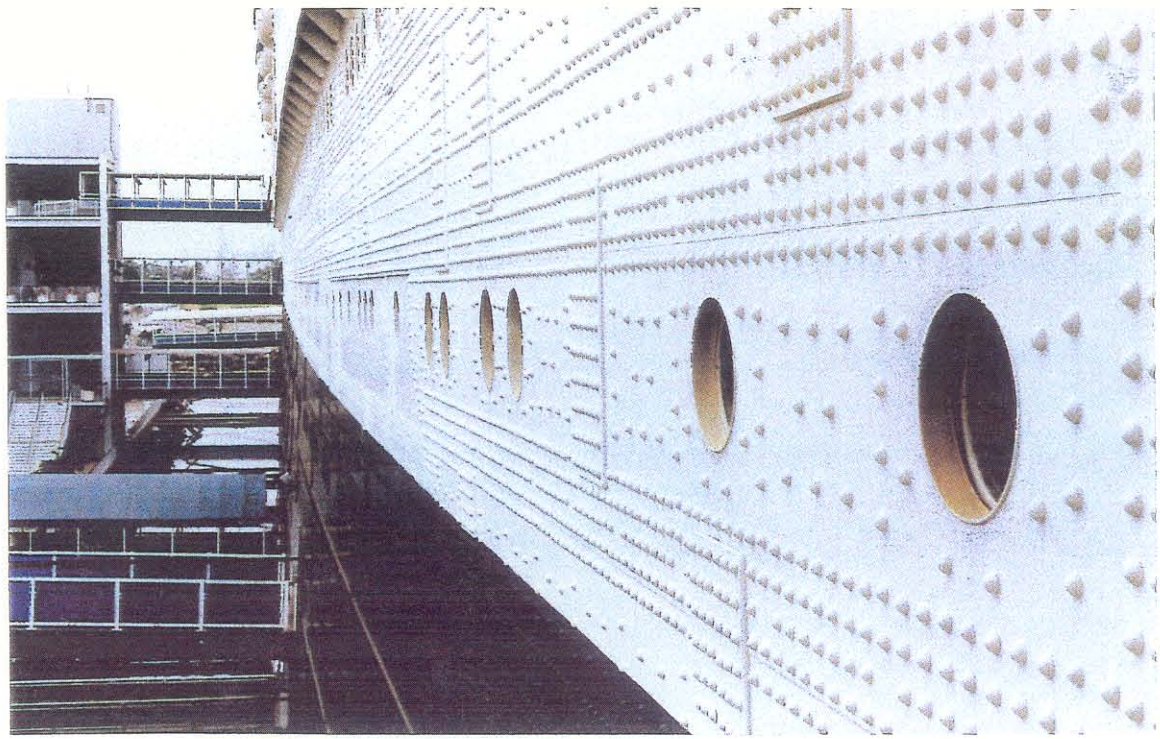
The steel frame-spacing within the ship varies from 24 inches at the bow and stern areas, to 36 inch spacing at the mid-section area of the vessel. These frames running athwartship (Port to Starboard) are .50 inches thick and have lighting holes cut out of the frames to reduce weight.

The Queen Mary was designed with thirteen (13) decks. The strength deck, namely the "A" Deck is .66 inches thick, while the other decks are .50 inches in thickness.

The hull area below the "R" Deck was subdivided into seventeen (17) watertight bulkheads with access through remote controlled watertight doors. These bulkheads and doors were constructed using .50 inch plate.

As the vessel exists today, only two originally constructed watertight bulkheads remain as initially constructed. The remaining fifteen (15) W.T. Bulkheads have been extensively modified or have had major portions of the bulkheads removed. Additionally, none of the remote controlled watertight doors initially installed in the bulkheads are operable. Most have been locked in the open position with pneumatic piping disconnected.

The hull structure of the vessel was constructed using ten million steel rivets to fasten the steel plates to the scantlings. These rivets were 1-1/8 inch in diameter and varying from 2 to 6 inches in length. The hull structure in terms of strength, far exceeds current construction methods, and is considered one of the strongest commercial passenger liners ever built.



**HULL PLATING AND RIVETING PORT SIDE**

During the construction of the Queen Mary, asbestos containing materials (ACM) were used in practically every form of marine construction providing thermal protection, insulation and fire protection to piping, interior bulkheads and compartmentation boundaries. A typical product used aboard the ship was "Turnall Asbestos Wood". This material will not burn and resists fire. This material was used in the construction of staterooms, hallways, lounges, dinning rooms, restaurants, offices, etc. ACM was used for pipe insulation as well as ducting for air and heating, and it was used as insulation and sound proofing for machinery equipment, boiler rooms, electrical wiring systems, and the like.

The ship contains 13 elevators, which were installed in 1934 to move passengers from deck to deck. These elevators were not fully automatic and do not meet state and federal requirements.

The HMS Queen Mary contained 321 first class staterooms, 347 cabin class rooms and 281 tourist class cabins, for a total of 949 staterooms for the passengers located on Main; "A" and "B" Decks. There were also staterooms for 1174 officers and crew.

**TYPICAL STATEROOM**

The ship contained three (3) separate zones for the passengers, the bow section contained the tourist class, the midship section contained the first class, and the aft section contained the cabin class. Each zone had their own cabins, dining facilities, restaurants, galleys, lounges and entertainment areas.

The HMS Queen Mary contained 27 boilers and four turbine engines producing 200,000 horsepower, thus producing a speed of 31.69 knots (37 mph).

The ship contained (24) lifeboats, each carrying 124 people. The boats contained diesel engines and supplies. The Queen Mary's illustrious career included 2,114,000 paying passengers and a total traveled distance of 3,807,277 nautical miles. she saw service as a troop carrier, hospital, and British command ship.

# Volume III
# SECTION IV

*QUEEN MARY*

## VESSEL ANALYSIS

**AN INVESTIGATION OF**
**THE QUEEN MARY**
**PERFORMED SEPTEMBER 26, 1990**
(REQUESTED BY PORT OF LONG BEACH)

# QUEEN MARY
# VESSEL ANALYSIS

## INVESTIGATION OF THE QUEEN MARY STRUCTURAL ANALYSIS STUDY

Sometime after the conversion of the Queen Mary, which occurred during the period of 1968-71, several conditions concerning buckling of the decks appeared. After a thorough investigation and analysis of the complete structure it was determined that the primary reason for these distortions, was the removal of internal bulkheads and trunks to allow access for rip-out and removal of the ships boilers and equipment and re-installation of replacement materials and equipment. These removed structures were never reinstalled by the contractor due to proposed future developments of the lower areas. Other remaining structural members were modified to enlarge interior areas and only local strength members were replaced.

### I. DECK BUCKLING

#### 1. "A" Deck Frames 255 - 258 - "Restroom"

"A" deck, frames 255 - 258, show evidence of overstress in the form of deck buckling and distortion in an area 3 feet x 5 feet on the port side of the vessel.

The buckling appears near the middle of a structural deck area (panel) between frames 255 and 261 and from the ships centerline to the inboard longitudinal system at 14'-6" starboard. Originally, this panel had support assistance from bulkheads over and under at 10'-0" off centerline. These bulkheads were removed. As a consequence, the panel size was doubled by removal of the centerline structural bulkhead. (Note: Some wooden joiner bulkheads were put back in, but provide no structural support).

The buckled "A" deck at frames 255 - 258 is located in a public restroom. Recommended repairs would be the installation of a 3", schedule 40 pipe stanchion between "A" deck and "B" deck at frame 257. Retile floor area as necessary.

"A" DECK RESTROOM - FR. 255 - 258

This would not impair the use of the lock shop existing on "B" deck below. A bulkhead below "B" Deck would carry out this loading.

Amount $ 2,095.00

2. "B" Deck Frames 177 - 180 — "Fan Room"

"B" deck, frame 178, shows evidence of overstress in the form of deck buckling and distortion in an area about 5 feet x 5 feet in the Fan Room near centerline. This area is occupied by ship's service personnel.

This 15 foot section of decking on "B" deck separates two (2) large openings, namely the uptake truck No. 2 and the open area providing the high overhead for the Main Convention Hall. This deck was originally supported by the uptake trunk bulkheads. With the removal of the trunk, stanchions were installed to carry vertical loads, but they give little support for horizontal loads, either fore-and-aft or transverse. The horizontal loads would come from twisting motions on the ship's fendering system and some combined loads due to hogging of the vessel. Whereas sagging is the drooping of the midship portion relative to the bow and stern, hogging is the straining of the ship which makes the bow and stern lower than the midship section.

Since any stiffening or cross bracing in the middle of the Windsor room would be unacceptable, it is recommended to just keep a periodic review of the deck area. It is anticipated that the buckling and distortion will not continue, as long as no additional loads or excess hogging conditions occur, and if the present fendering system is modified to incorporate rubber fenders. We Recommend that the areas be paved over the height of the ripples on "B" deck to eliminate possible tripping hazards.

Amount **$ None**

3. <u>"C" Deck Frame 191 — "Passageway"</u>

An investigation of "C" deck, at frame 191, approximately 28 feet, port side, shows evidence of overstress in the form of deck buckling and distortion. This area is approximately 2 feet x 3 feet and is located in a passageway used by the ship's tour.

The "C" deck was originally designed near the neutral-axis of the hull girder, and therefore, did not receive much stress loading from hogging and sagging of the hull. During the conversion, the "R" deck was decked-in completely and became the new "upper flange" of the hull girder.

With much of the uptake trunk structure removed, it effectively formed an expansion joint down to the "R" deck to work with the existing expansion joint at frame 180-1/2, thus relieving the Main deck as the upper flange.

Cutting away of large arches through the main longitudinal bulkheads, 14'-6" port and starboard at frames 190 - 192, has occurred for tour viewing of the Boiler Room spaces. Even though stanchions were installed to carry vertical loads, they are not effective when resisting the new hogging, torsional loads and fender loads. Recommend removing section of deck and replace with new plating.

Amount **$ <u>1,850.00</u>**

4. "D" Deck Frame 111 - "Convention/Exhibit Area"

"D" deck at frame 111 revealed that the only buckling and torsion that occurred was due to the underlayment of cement. The underside of the decking appeared to be free from undue stress and buckling. With the modification to the fendering system there should be no concern regarding deformation of "D" deck and its related structure. Repairs have been made by the ship's maintenance crew.

## II. PIPING SYSTEMS - BILGE TRANSFER SYSTEM

The bilge transfer costs are included in Section 7, Mechanical and Piping System Report

# HOTEL QUEEN MARY
# VESSEL ANALYSIS

## HULL STRUCTURE ANALYSIS

## SUMMARY SHEET

| No. Description | Qty. | Mat'l. | Labor | Immed | Defer | Total |
|---|---|---|---|---|---|---|
| I. DECK BUCKLING: | | | | | | |
| 1 "A" Deck - Restroom | 1 | 295.00 | 1800.00 | 2095.00 | ------- | 2095.00 |
| 2 "B" Deck - Fan Room | 1 | ----- | ------ | ------- | ------- | None |
| 3 "C" Deck - Passageway | 1 | 250.00 | 1600.00 | ------- | 1850.00 | 1850.00 |
| 4 "D" Deck - Restroom | 1 | ------- | ------- | ------- | ------- | None |
| II. PIPING SYSTEMS: | | | | | | |
| See Section VII - Item 7 | | | | | | |
| | | TOTAL | | **2095.00** | **1850.00** | **3945.00** |

# Volume III
# SECTION V

## *QUEEN MARY*

## VESSEL ANALYSIS

## AN INVESTIGATION OF THE QUEEN MARY EXTERIOR AND INTERIOR HULL PLATING STUDY PERFORMED DECEMBER 1990

(REQUESTED BY PORT OF LONG BEACH)

# QUEEN MARY
# VESSEL ANALYSIS

## AN INVESTIGATION OF THE EXTERIOR AND INTERIOR HULL STUDY PERFORMED DECEMBER 1990

A survey was performed for the Port of Long Beach to investigate the condition of the Queen Mary, primarily in the areas of the breasting structure, propeller box, bilges and swimming pool. The following report and findings are submitted.

### 1. BREASTING STRUCTURE:

Inspections revealed that the coating has deteriorated and disbanded and is not effectively coating the structure in the splash zone. To inhibit corrosion of the wetted surface of the structure at the waterline at various tide levels, requires corrective welding and reapplication of the corrosion resistant coating. Cathodic protection is not effective in areas such as the splash zone which are not completely submerged.

**BREASTING STRUCTURE**
**V - 1**

The Breasting Structures should be sandblasted and re-coated to inhibit future corrosion.

Amount $ 4,425.00

## 2. PROPELLER BOX:

The propeller box has been cleaned and repaired by the Disney Company and an automatically controlled impressed current rectifier, (Cathodic Protection System) has been installed to eliminate future corrosion to the steel box structure. Chemicals are routinely added to the fresh water in the structure to minimize imbalances and abate corrosion.

Interior and exterior sections of the propeller box welding seams, are deteriorated and will require future rewelding. This will require the services of an underwater diver to clean the exterior areas and reweld. Interior areas will require the removal of water from the box, erection of staging and welding of seams.

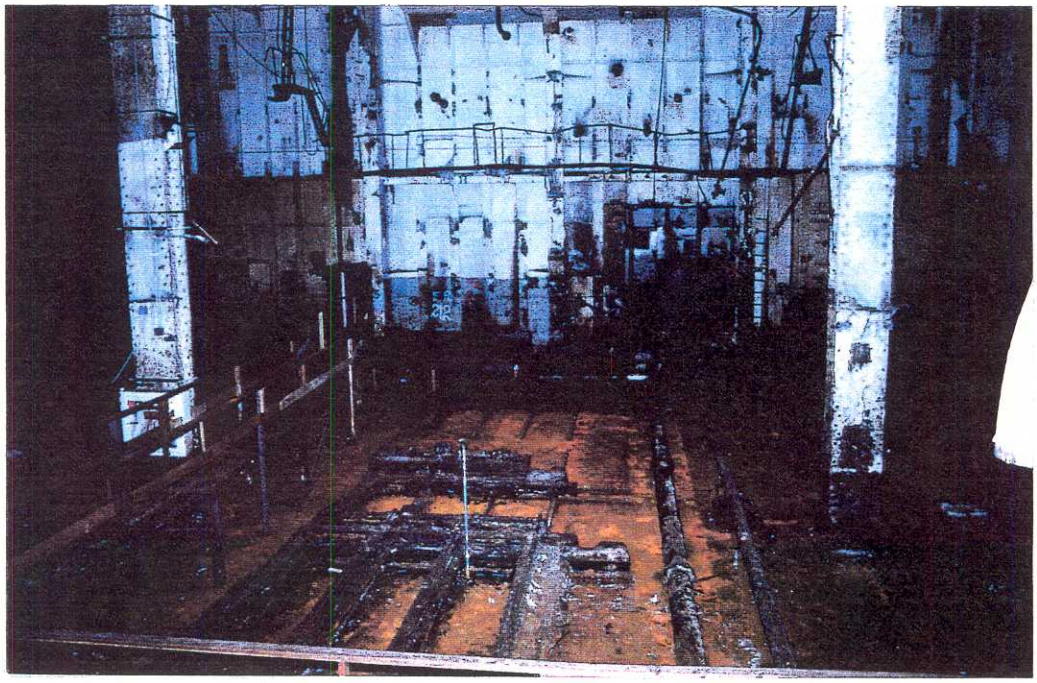
Amount $ 23,250.00

PROPELLER BOX

## 3.-23. HULL BILGES - FRAMES 300-51 (item 13 excluded):

The Bilge and Interior Bilge areas of the Boiler Room, Generator, Engine Room Shaft Alley, Refrigeration Room and Aft Steering Compartment were inspected in those areas that were accessible and free of Asbestos Containing Material (ACM).

The Boiler Room, Generator and forward Engine room frames 112 to 289 are contaminated with ACM and therefore, unavailable for close inspection and Audio Gauging of tank tops to determine plate thickness. During the past number of years contaminated water, trash, debris, and dissimilar metals, have laid in the bilge area causing considerable corrosive action to the tank tops and structures.



**BOILER ROOM No. 3**
**AND DOUBLE BOTTOM TANK TOPS**

The contaminated water has been removed from the boiler room bilge area and visual inspections indicate considerable corrosion has occurred to tank tops and structures.

FWD TURBO GENERATOR ROOM - BILGE

BOILER FOUNDATION
AND
ACCESS TO DOUBLE BOTTOM TANKS

Due also to the continuous falling of ACM fibers from the overhead panels, the area is restricted for performing further studies and reports.

An immediate concern should be to remove the Asbestos Containing Materials, and sandblast and paint to further reduce deterioration of the plates and structure. As shown in the photographs, there is no watertight integrity within the respective compartments because of the removal of portions of the watertight bulkheads. Should the vessel for some reason incur a serious, fast flowing leak, damage control in limiting the compartments to be flooded would be non-existent. A serious, un-manageable leak would most likely cause the structure to sink.

The aft section of the Bilge, until recently, had also been filled with contaminated water, debris, trash and dissimilar metals which has caused extensive corrosion to the hull plating, rivets and structures. The majority of contaminated ballast water in the double bottom tanks, has been removed and drilling mud has been inserted as ballast in the double bottom tanks. Trash, debris and dissimilar metals are still present in the bilge aft, thus, a corrosive action and further deterioration of plating, rivets and structure still exists.

**BILGE DETERIORATION**
**CENTERLINE / AFT**

This area also contains loose ACM.

Removal of ACM and trash from the after section of the vessel should also be initiated. Until this area is cleaned and sandblasted, readings cannot be taken in the critical areas. The areas above the contaminated bilges indicate a corrosion loss of approximately 15 %.

| | |
|---|---|
| ACM Removal | $ 780,000.00 |
| Clean, Sandblast & Paint | $ 1,950,000.00 |
| TOTAL | **$ 2,730,000.00** |

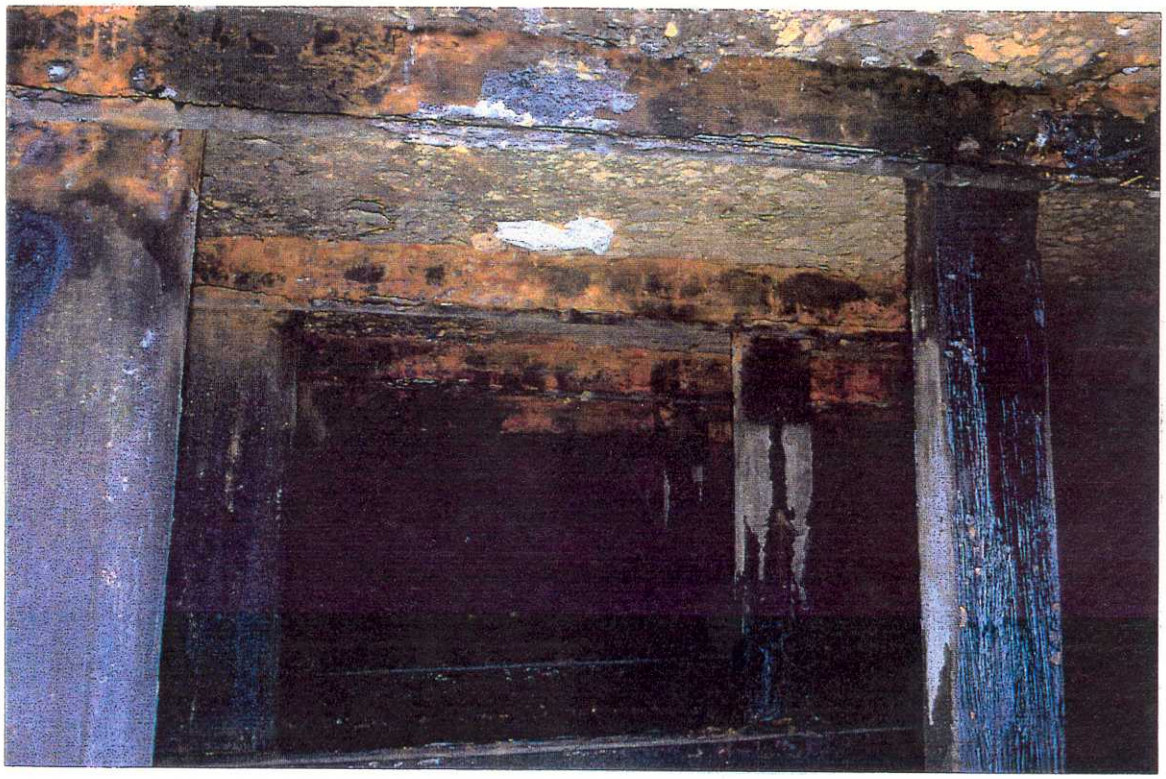
## 13. INDOOR SWIMMING POOL:

The Pool is of rectangular shape, 35 feet long and 22 feet wide. The depth varies from 7 feet to 8 feet, 6 inches. The capacity of salt water used in the pool is about 29,000 gallons with a weight of approximately 109 long tons.

The pool is located between "C" and "D" Deck between frames 212 to 222 at the centerline of the structure. The top of the pool and exposed structures on or above are covered with decorated tiles about one inch thick. Severe cracking and deformation of the tiles and concrete underlayment occur when the pool is filled with water.

1ST CLASS SWIMMING POOL

Investigations of the Pool Complex revealed that due to the number of years of continuously using salt water in the pool combined with the heat generated by operation of the generators below, and the moisture trapped in the enclosed structure beneath the pool, the steel lining and structural members of the cofferdam of the pool have severely deteriorated. Should the pool be considered operational at some future time, expensive repairs would be required. Additionally several supporting structures on the port side of the pool structure were removed during the conversion to accommodate the application of cement on the floor of "D" deck. This removed structural support, adds significantly to the movement of the pool and has created the cracks to the pool cement and tile. This movement appears to be most prevalent when the pool is filled.



**STRUCTURAL FOUNDATION**
**UNDER 1ST CLASS POOL**

A structural analysis of this area is required to establish the requirements for installation of transverse bulkhead structures deemed necessary.

The Ultrasonic Thickness Measurements for the Swimming Pool Area are:

| | Area Thickness | | |
|---|---|---|---|
| Location | Max | Min | Average |
| Port Side | 0.440 | 0.070 | 0.317 |
| Bow Side | 0.450 | 0.375 | 0.380 |
| Starboard Side | 0.370 | 0.055 | 0.178 |
| Lower Plate | 0.475 | 0.050 | 0.366 |

The minimum thickness readings are from isolated locations, around the pool structure.

Amount **$ 225,000.00**

# QUEEN MARY
# VESSEL ANALYSIS

## HULL STRUCTURE ANALYSIS

## SUMMARY SHEET

| No. | Description | Qty | Mat'l | Labor | Immed | Defer | Total |
|---|---|---|---|---|---|---|---|
| 1. | Breasting structure | 2 | 1,500.00 | 2,925.00 | 4,425.00 | ------ | 4,425.00 |
| 2. | Propeller Box | 1 | 4,500.00 | 18,750.00 | ------ | 23,250.00 | 23,250.00 |
| 3. | Internal bilges Frame 300-51 | 1 | 630,000.00 | 2,100,000.00 | 2,730,000.00 | ------ | 2,730,000.00 |
| 4. | Swimming pool | 1 | 65,000.00 | 200,000.00 | ------ | 265,000.00 | 265,000.00 |
| | | | | **TOTAL** | **2,734,425.00** | **288,250.00** | **3,022,675.00** |

# Volume III
# SECTION VI

*QUEEN MARY*

## VESSEL ANALYSIS

## CURRENT
## HULL ANALYSIS
## AND
## REPORT OF FINDINGS

# QUEEN MARY
# VESSEL ANALYSIS

## CURRENT
## HULL ANALYSIS
## AND
## REPORT OF FINDINGS

The Hull Structure of the Queen Mary was investigated for purposes of determining the Projected Cost Estimated (PCE) to bring the hull structure up to industry standards. No shore facilities or functions were studied with the exception of mooring lines, gangways and breasting structures.

The hull characteristics of the Hotel Queen Mary since the conversion during the period of 1968-1971 are as follows:

| | | |
|---|---|---|
| Draft | 34.5 | Feet |
| Ship Weight | 44,225 | Long Tons |
| Liquid and Ballast | 22,501 | Long Tons |
| Total Displacement | 66,726 | Long Tons |

The exterior underwater hull plating (150,000 square feet) and rivets were not inspected by underwater divers due to time restraints and cost restriction.

## HULL STRUCTURE

### 1. A. Hull Exterior - Below Waterline (Drydocking)

During the conversion period of the Queen Mary, Rados developed a "Hull Corrosion Study" for the Long Beach Queen Mary Department for purposes of determining theoretically the projected amount of plate wastage (deterioration) that would occur during the life of the vessel. The conclusion of the study revealed that within a period of twenty-five (25) years the Queen should be re-drydocked to inspect and repair deteriorated plating, rivets, and plate inserts that have covered the one-hundred (100) sea chest openings. The hull structure should be cleaned, sandblasted, and painted within the next 3 to 5 years.

This "Corrosion Study" took into consideration the cathodic protection system (impressed current) presently existing aboard the Queen Mary which consists essentially of ten (10) rectifiers of which five (5) rectifiers are utilized for protection of ships hull.

**HULL CORROSION - SPLASH ZONE**

In order to drydock the Queen Mary, a portion of the rock dike has to be removed and then again reinstalled along with gangways, connections and mooring lines, etc.

| | |
|---|---|
| Remove and Reinstall Rock Dike, Gangways, etc. | $ 2,360,000.00 |
| Drydock & Sandblast, Repairs & Paint | $ 3,900,000.00 |
| Amount | $ **6,200,000.00** |

## B. Hull Exterior - Above Waterline

The exterior are of the Queen Mary will require painting within a period of 1 to 2 years in order to control the rust and deterioration of structure. Staging will be required to paint sides, superstructure, funnels and mast.

Amount $ **650,000.00**

C. Hull Interior - Bilge Area

After asbestos containing material is removed from tank tops and bilge areas, cut and remove rusted and deteriorated former boiler foundations. Sandblast and clean area and repair as necessary. Paint total area of bilge up to "D"-Deck and up to "F"-Deck where shell is enclosed. Painting is to include framing, bulkheads, tank facing and interconnected steel work including underside of decks.

Amount $ See Section V Item 3

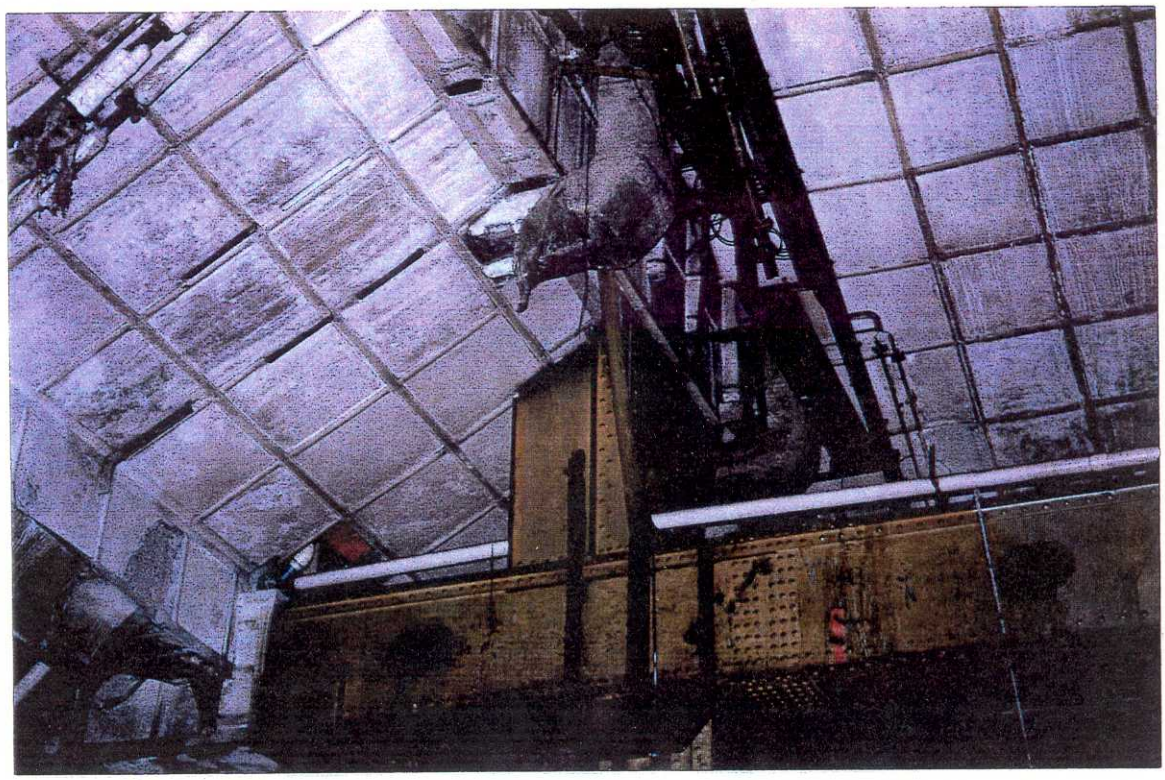
## 2. WATERTIGHT BULKHEADS:

The Queen Mary was designed and constructed with eighteen (18) watertight bulkheads from the double bottom tanks (tank top) to the "F"-Deck forward (approximately 35 feet high) and "G-Deck Aft (approximately 20 feet high). These structural bulkheads were constructed from .50 inch plate with seven (7) 4'-6" x 18-1/2" I-beams and thirty-five (35) 10" x 7" x 1/2" I-beams spaced in between for stiffeners per bulkhead.

Due to the removal of boilers, generators and machinery during the 1968-71 conversion period, the majority of bulkheads were partially removed to allow space for removal and re-installation of materials and equipment. They were not replaced for structural strength or watertight integrity for reasons of future development of those areas. Presently there exists extensive corrosion to the bulkheads where they come into contact with the contaminated bilges.

As previously mentioned, the Queen Mary has no watertight integrity as required by regulatory bodies for a floating structure. If a certain hull plate or plates became defective and water leaked into the structure it could not be contained due to the present status of the non-watertight bulkheads and therefore the water would flood the whole structure and very probably sink. This major concern is perhaps the most serious condition aboard the ship from a naval architecture point of view.

Presently, the majority of the tank top areas are covered with Asbestos Containing Material (ACM). This is due to the ACM panels that were installed in the uptakes (stack area) to provide for heat retention within the machinery spaces and avoid penetration into the staterooms and other areas. This hazardous material would be required to be removed by a qualified firm prior to any work is preformed in these areas.



**ACM PANELS - UPTAKE**

To repair and replace watertight bulkheads only small sections of steel can be used due to limited openings in the hull structure. Extensive amounts of staging would be required to handle and erect the following watertight bulkheads.

Watertight bulkhead 21 is forward of the propeller shaft tunnel. This area appears to have heavy corrosion due to contaminated water, trash and dissimilar metals laying in bilge area. This bulkhead is penetrated by pipes and ducts. The penetration should be blanked-off and four (4) watertight doors installed for watertight integrity.

Watertight bulkhead 87 has a large opening that requires plate replacement and stiffeners. Miscellaneous penetrations are to be blanked-off and two (2) watertight doors installed.

Watertight bulkhead 112 is partially watertight up to the twelve (12) foot flat. Steel plate and stiffeners are to be installed up to the "F"-Deck for watertight integrity. Penetrations to be blanked-off and two (2) watertight doors installed.

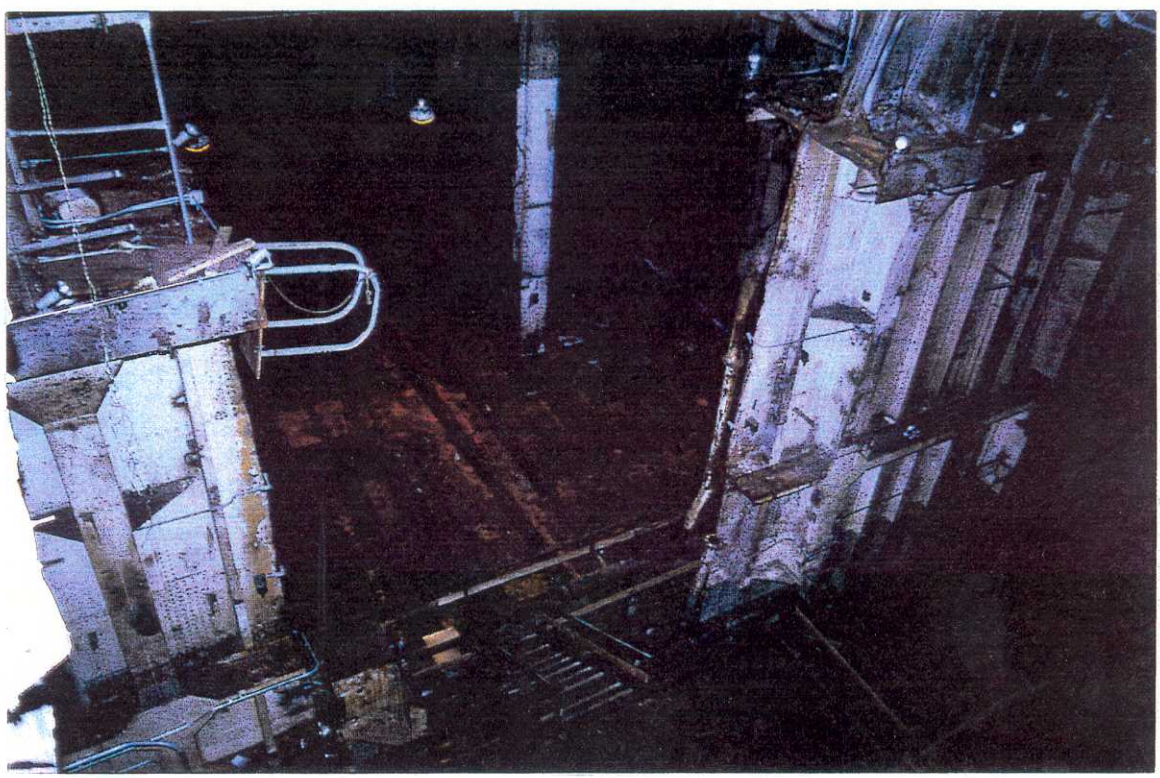
Watertight bulkhead 168 has four (4) large open areas at the 11-foot flat that requires re-plating and installation of stiffeners. Piping runs and ventilation duct openings require closures to make watertight. Install one (1) watertight door.

Watertight bulkhead 222 is partially watertight up to the "D"-Deck. Several penetrations are to be blanked-off and collars around bilge pipes and a watertight door is to be installed.

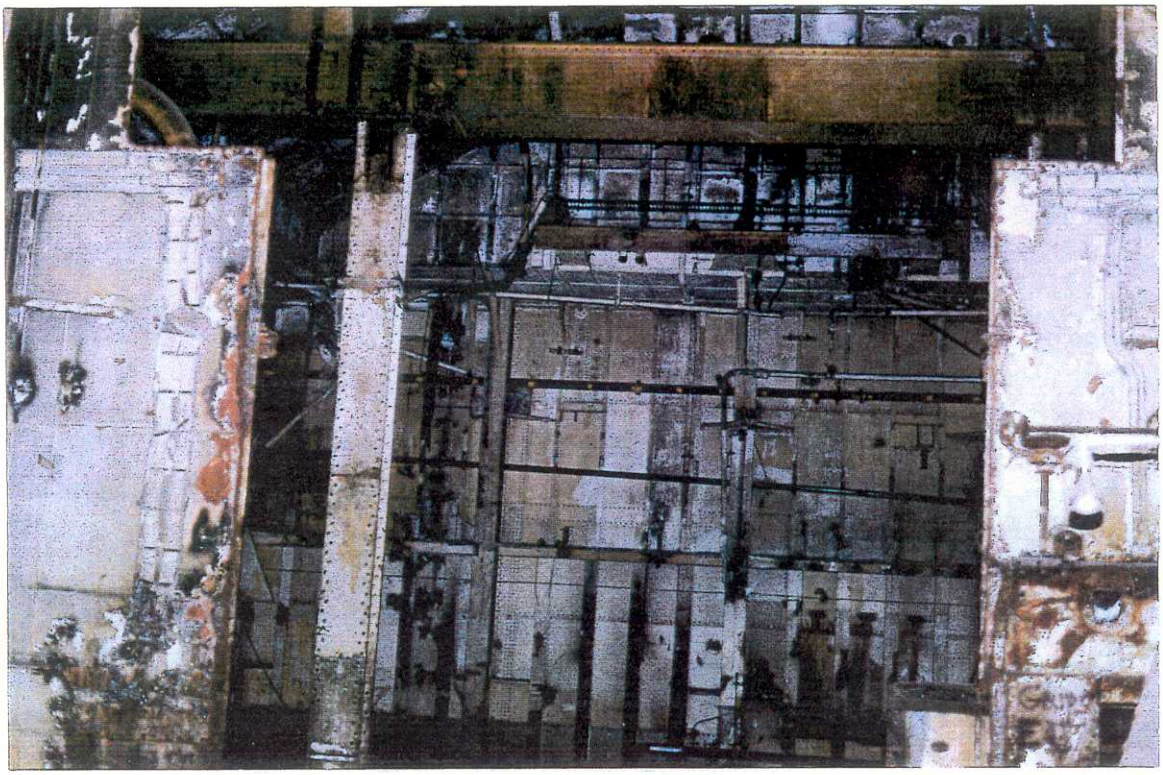
Watertight bulkheads 260 & 311 requires major replacement of plating and stiffeners to "F"-Deck. Installation of a watertight door is required and penetrations blanked-off.

Of the seventeen (17) watertight structural bulkheads in the lower portion of the ship, only two (2) were not modified as a consequence of the conversion modifications. Of the fifteen (15) that were modified, bulkheads 51, 112, 136, 168, 222 and 260 should be repaired/replaced to insure watertight integrity.

Amount $ **1,890,500.00**



**BULKHEAD 190**
**TYPICAL CONVERSION MODIFICATION**
**TO WATERTIGHT BULKHEAD**



**REMOVED SECTION**
**WATERTIGHT BULKHEAD 244**
**LOOKING AFT TO BOILER ROOM No. 2**

## 3. EXTERIOR DECKS:

### A. REPAIR AND REFINISH

The exterior teak wood decks that have been exposed to the water and weather conditions during the past fifty-six years, have weathered considerably, and caused seepage of moisture through the seams and plugs. This leakage has caused corrosion to the steel decks underneath the wood decking. Even though some of the deteriorated wood has been replaced, it has been reported that leaks appear in compartments below. It is recommended that the balance of the deteriorated teak decks be repaired by removing and replacing of plugs and seam compound and refinishing of the 153,000 square feet of decking.

Amount **$ 710,000.00**

## B. REMOVE AND REPLACE:

1) It is the opinion of the team of engineers that within the next 3 to 5 years the teak-wood decking would be required to be removed and sections of the steel deck plating beneath, be repaired or replaced to eliminate leakage of water into compartments below.

Amount $ 2,950,000.00

**SECTION OF REMOVED TEAK DECK SHOWING CORRODED STEEL DECK PLATING**

**SPORTS DECK - WEATHERED TEAK DECK**

2) An option to the removal of teak decking and the replacement of sections of the steel plating underneath, is the installation of new teak decking over the existing decks. This method includes the installation of one (1) inch thick teak decking fastened to the existing decks, fastening holes plugged, and caulking of all seams with weatherproof caulking.

Amount $ 1,200,000.00

## C. REPAIRS TO "R" DECK:

All interior decks have been inspected and are (with the exception of a section of the Galley "R" Deck), in sound and good condition with minimum appearance of corrosion. Vinyl floor tile that exists throughout the decking of the Queen Mary contains Asbestos Material and should be replaced with Non-Asbestos Contained Material. The section of the Galley Deck which has deteriorated, requires replacement due to corrosion from water and electrolysis.

Amount $ 25,000.00

The Ultrasonic Thickness Measurements for the various steel decks are as follows:

**Area Thickness**

| Deck | Max | Min | Average |
|---|---|---|---|
| "R" | 0.400 | 0.065 | 0.250 |
| Sun | 0.400 | 0.075 | 0.235 |
| Promenade | 0.400 | 0.055 | 0.267 |
| Main | 0.405 | 0.060 | 0.385 |
| "A" | 0.505 | 0.475 | 0.490 |

The minimum thickness readings are from isolated locations on respective decks.

## 4. HULL STRUCTURE EXPANSION JOINTS

The initial design of the Queen Mary incorporated three (3) expansion joints spaced throughout the length of the ship, to absorb the impact and movement of the ships decks and structures from the motions of heavy seas. These three (3) expansion joints running from port to starboard were installed at frame 145 1/2 on the Sun Deck, frame 180 1/2 on the Sun Deck and frame 228 1/2 on the Sports Deck/Sun Deck. Due to corrosion of the steel trough on the underside of the deck joint, water is leaking into the ballrooms and lower compartments.

It is recommended that the deck cover plates be removed, to sandblast and repair the interior of the steel troughs. New overboard discharge lines to be installed and the cover plates reinstalled.

Amount **$ 150,000.00**

## 5. ELEVATORS AND ESCALATOR

It is recommended that the machinery and electrical equipment from seven (7) non-operating elevators be disassembled and removed and replaced with updated components to make fully automated.

The shaft areas of the elevators are coated with Asbestos Containing Material.

This ACM will be required to be removed prior to any performance of work.

One (1) escalator in the convention area has a defective gear box and requires repairs and replacement of parts.

Amount $ 1,925,000.00

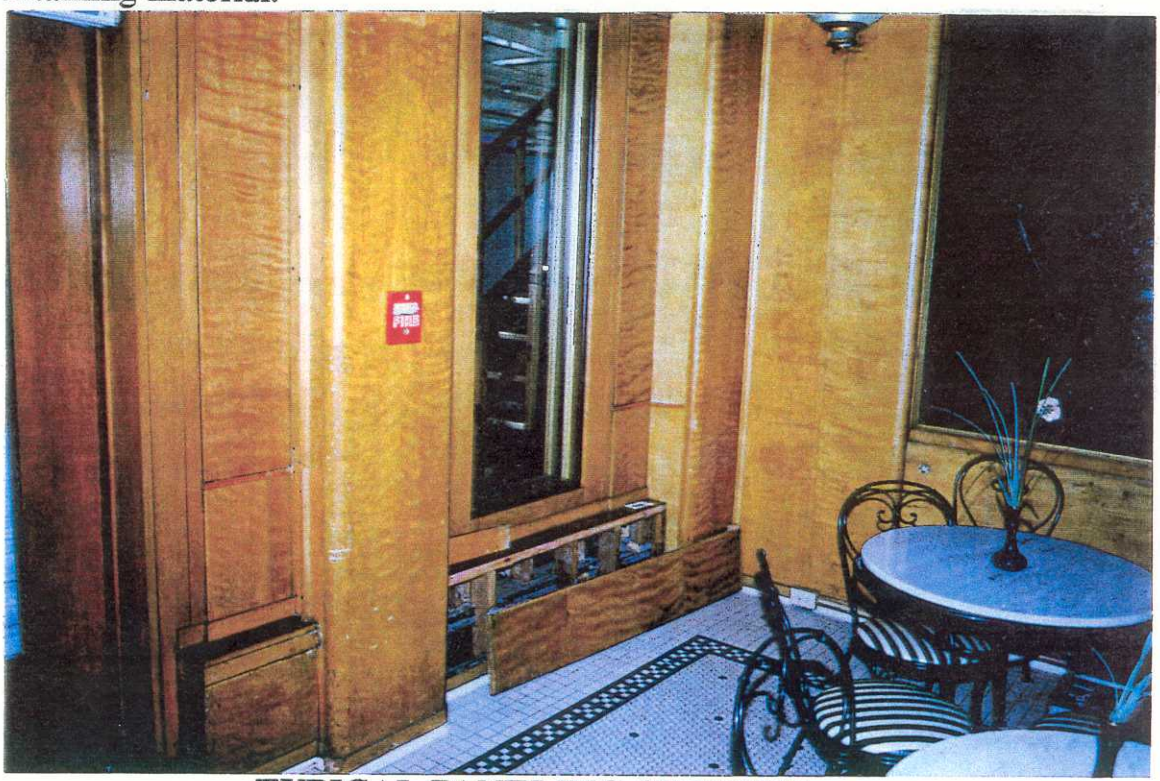
## 6. ASBESTOS CONTAINING MATERIAL (ACM)

An investigation of available information, specifications and plans, and an inspection of the Queen Mary structures was made to determine an approximate extent of Asbestos Containing Material presently existing aboard the vessel.

The following materials and areas contain ACM:

### Wood Paneling:

In the construction of the Queen Mary in 1936, the Turner Asbestos Cement Company developed a new fireproof panel called "Turnall Composite Board". This panel consists of a plywood layer, a middle layer of asbestos sheet, and a back layer of plywood. A decorative wood panel was applied over the Turnall Board. All the paneling in staterooms, hallways, lounges, restaurants, etc. contain asbestos containing material.



**TYPICAL PANELING SECTION**
**PROMENADE DECK, PORT SIDE**

**TYPICAL ASBESTOS INSULATION**
**INSIDE WOOD PANELING**

**Ceiling and Wall Insulation:**

Turner Asbestos Cement Company also supplied a "Turnall" asbestos reinforced aluminum foil. This was used to keep temperature fluctuations to a minimum in the center of the structure where boiler up-takes rose through the stacks. There exists unconcealed ACM in the overhead of the boiler rooms, 4" thick spongy blue material sandwiched between steel decks and outer metal or transit coverings.

**Spray-On:**

Spray-on thermal insulation was found in several locations throughout the structure. This material is on fire walls, bulkheads, elevator shafts, support beams, bulkhead penetrations, pipe runs, electrical load centers and on ventilation ducts.

**Engine Room:**

Machinery, equipment, exhaust lines, pipes, and ducting contain Asbestos Containing Material the purposes of reducing temperatures in the engine room areas.

**Electrical Wire Wrap:**

The older electrical wires originally installed, have an asbestos containing white cloth-like wrap. Abandoned wrapped wires can be found in wooden or metal raceways throughout the ship.

**Vinyl Floor Tile:**

Vinyl floor tile is located in various areas such as lobbies, bathrooms, locker rooms, hallways and kitchens. This floor tile contains asbestos material.

**Boiler Rooms:**

Presently the 46,000 square foot area in the forward boiler and generator rooms has been closed to the public due to exposure of hazardous materials. It is also closed to the crew except for situations which provide for the wearing of proper apparel.

Substantial amounts of asbestos containing material will be required to be removed from the structure both in the overhead panels as well as from the bilge areas, for continued operation of the Queen Mary and for any modification to the structure complex.
*(Note: This item is covered in Section V, item 3)*

**TYPICAL PIPE LAGGING**
**"C" DECK WORKSHOP, PORT SIDE**

As a result of needed repairs performed on a continual basis to specific areas of the structure and systems, ACM will be required to be removed in those areas.

Requirements of regulatory bodies specify that ACM does not need to be removed in those areas that are left undisturbed, and those where ACM is contained and no airborne particles are present.

Amount $ 2,000,000.00

## 7. Handicap Accessibility

An inspection of the Hotel Queen Mary revealed a low level of handicap accessibility to most public spaces. Any future modifications to the structure will be required to be in full compliance with the State Building Code for handicap accessibility.

Amount $ 25,000.00

## 8. Occupant Egress

Signage is to be installed in all passage ways and stairwells to inform occupants of escape routes in case of emergency.

Amount $ 20,000.00

## 9. Pest Control

Fabricate and install approximately 500 port light, (port-hole) screens to eliminate birds from entering.

Amount $ 8,500.00

## 10 Mooring Lines

The inspection of mooring lines indicate a majority of the wire cables require replacement due to corrosion from the saltwater atmosphere. Investigation of all pad eyes and fittings for repairs and replacement, to be performed.

Amount $ 48,000.00

## 11 Life Boats

Repair of the twenty two (22) steel life boats, replace sections of deteriorated bottoms and repaint.

Amount **$ 100,000.00**

# QUEEN MARY
# VESSEL ANALYSIS

## HULL ANALYSIS

## SUMMARY SHEET

| No. Description | Qty | Mat'l | Labor | Immed | Defer | Total |
|---|---|---|---|---|---|---|
| 1. Hull Exterior (Drydock)<br>A Below waterline | | | | | 6,200,000. | 6,200,000. |
| B Above waterline | | | | | 650,000. | 650,000. |
| C Bilge areas | | | | | | SECTION V |
| 2. Watertight Bulkheads | | 200,000. | 1,690,000. | 1,890,500. | ------ | 1,890,500. |
| 3. Exterior Deck<br>A Repair & Refinish | | 150,000. | 560,000. | | 710,000. | 710,000. |
| B. Remove & Replace | | 1,400,000. | 1,550,000. | | 2,950.000. | 2,950,000. |
| C. "R" Deck Repair | | 5,000. | 20,000. | | 25,000. | 25,000. |
| 4. Hull Expansion Joints | | 25,000. | 125,000. | | 150,000. | 150,000. |
| 5. Elevators and Escalator | | | | | 1,925,000. | 1,925,000. |
| 6. Asbestos Containing Material | | | | | 2,000,000. | 2,000,000. |
| 7. Handicap Accessibility | | | | 25,000. | | 25,000. |
| 8. Occupant Egress | | | | 20,000. | | 20,000. |
| 9. Pest Control | | | | | 8,500. | 8,500. |
| 10. Mooring Lines | | | | | 48,000. | 48,000. |
| 11. Life Boats | | | | | 100,000. | 100,000. |
| | | | TOTAL | 1,935,500. | 14,766,500. | 16,702,000. |

# Volume III
# SECTION VII

*QUEEN MARY*

## VESSEL ANALYSIS

## CURRENT
## MECHANICAL AND PIPING SYSTEMS
## REPORT OF FINDINGS

# QUEEN MARY
# VESSEL ANALYSIS

## MECHANICAL AND PIPING SYSTEM

### INTRODUCTION

The Mechanical Systems aboard the Queen Mary were designed by the John Brown Shipyard and installed primarily in the year 1934. During the year of 1967, Rados Engineers boarded the vessel during its second to the last Trans Atlantic Crossing for purposes of determining the condition of the Mechanical Systems. It was determined that the Machinery, Boilers, Air Conditioning Units, Sewage and Piping Systems were severely fatigued and deteriorated, and could not withstand the rigorous requirements of incorporating a Hotel, Restaurant, and Museum for the succeeding Thirty (30) year period.

During the conversion engineering of the Queen Mary in 1967, the Air Conditioning/Refrigeration System was re-designed to ultimately service all the spaces on board the ship. A central chill water plant which has the capacity of 2700 tons of cooling is supplied through sixteen-inch chill-water-mains to the ship. The chilled water is supplied from a Central Plant located on land at Pier J and then piped aboard the Queen Mary.

The Steam System is also supplied from the land based Central Plant at Pier J. The system contains 2 - 800 HP water tube boilers capable of producing 27,500 pounds per hour of 150 lb steam.

The Sewage System consists of a 250 cubic foot collection tank serviced by two 5000 gpm sewage pumps, and a 160 cubic food collection tank serviced by two (2), 200 gpm sewage pumps. PVC pipe has been installed aboard the Queen Mary to replace defective sewage piping. The raw sewage is piped overboard into the City sewer system.

A new Firemain System and Sprinkler Heads were installed during the conversion of the vessel to withstand City pressure requirements.

The Gas Line installed to service the galley's and other special requirements aboard the ship, also originates from city gas lines.

## I. Mechanical & Piping Systems

Since the installation of the mechanical and piping systems in 1968-1971 a minimum of maintenance has been performed on the equipment and piping systems. The equipment and majority of systems after being in operation for the past twenty two years will require major repairs or replacement of equipment and systems. The following information is submitted on the various mechanical and piping systems.

### A. Central Chill-Water Plant and Steam Plant.

The central on-shore energy plant has been designed to provide 2700 tons of refrigeration to the Q.M./Spruce Goose complex as mentioned in the introduction, in addition to a co-generation plant located near the ITS container facility, which is capable of producing 500 tons of refrigeration to the Spruce Goose dome. The 2700 ton capacity plant is provided by three (3) 800 ton units and one (1) 325 ton unit.

According to figures provided by the current tenant, Disney, the maximum refrigeration load during peak periods has been approximately 800 tons, thus only one of the 800 ton units is needed at any one time to provide for the demand and the rest of the units are on stand-by. Alternating the 800 ton units periodically will provide even wear and tear, and also keeps all units in service.

Steam supply to the Queen Mary is provided by two (2) 800 H.P. water tube boilers located at the central plant with a capacity of 27,500 #/STM/HR @ 150 PSI.

In summary, the central energy plant is more than adequate and in good condition.

### B. Heating, Ventilation and Air Conditioning - Existing Repairs

Due to the limited time frame available, the mechanical survey of shipboard HVAC equipment consisted of a search and review of as-built drawings and diagrams, operating procedures, and a spot-check examination of the supply and exhaust fans, air handling units, fan coil units, chilled water cooling coils, steam heating coils and their associated components.

## HEATING, VENTILATION AND AIR CONDITIONING DUCTING AND COMPONENTS

The approximate total of units presently installed on board the Queen Mary are as follows: (some are disconnected and/or not used).

a. Air Handlers = 33
b. Fan Coil Units =24
c. Supply Fans = 75
d. Exhaust Fans = 74

Due to the age of the equipment and the limited maintenance schedule, the following conditions prevail on an average basis, and are typical for the majority of the 206 HVAC Systems.

1. Air Handlers

a. Excessive corrosion exists around the unit casing and cooling coils (especially units exposed to the weather).
b. Condensate drain pans are corroded and some plugged not allowing proper drainage.
c. Flexible duct connectors have perforations and holes, and in some cases are torn or in a deteriorated condition.

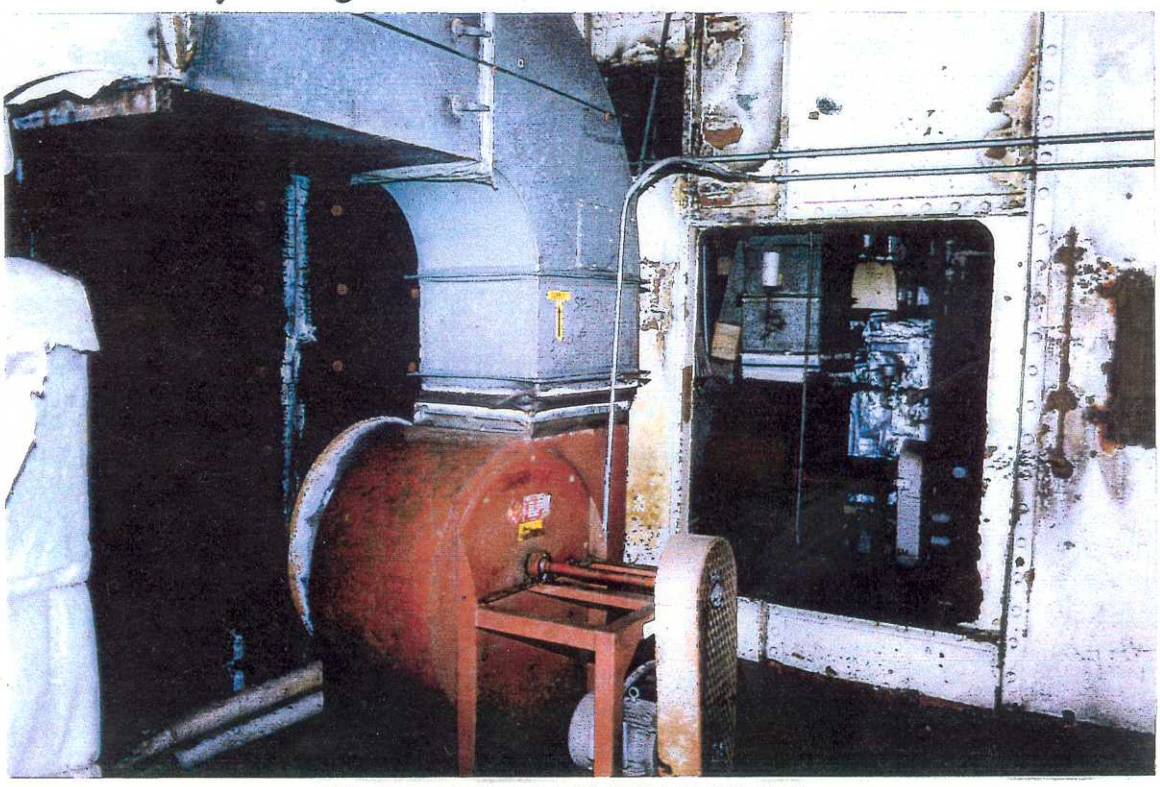
d. Air filters and cooling coil fins are excessively dirty. This greatly reduces air flow.
e. Chilled water piping at many units have missing and/or deteriorated thermal insulation, decreasing efficiency.

2. Fan Coil Units

a. Air filters and cooling coils are excessively dirty. In a few units the air filters are missing.
b. Condensate drain pans are corroding and some are plugged not allowing drainage.
c. Chilled water piping at many units have missing and/or deteriorated thermal insulation.

3. Supply Fans

a. Intake screens are very dirty and in some cases 60% or more clogged with dirt and/or paint which severely restricts the air flow and efficiency.
b. Systems that have heating and/or cooling coils have clogged or missing air filters.
c. Flexible rubberized canvas duct connectors have holes, and in some cases are torn or in a deteriorated condition.
d. Noisy bearings and out of balance fan wheels cause excessive vibration.



**SUPPLY FAN AT FRAME 178**

4. Exhaust Fans

a. Fans installed in weather locations show a lot of corrosion and a need for general clean up maintenance.
b. Flexible rubberized canvas duct connectors have holes, and in some cases are torn or in a deteriorated condition.
c. Noisy bearings and out of balance fan wheels cause excessive vibration.
d. Most of the exhaust fans installed in the weather, discharge vertically with no rain protection. Recommend installing goosenecks in these locations.

5. System Upgrade

To upgrade air conditioning for existing Hotel spaces a total of (18) new Fan Coil Units and their associated piping are to be installed in the following locations:

a. Royal State Rooms
M-121, M-125, M-131, M-135, M-139 and M-141

b. Mini Suites
A-007, A-008, A-125, B-317, B-318, B-424, B-4425, M-017 and M-018

c. Suites
M-102, M-104 and M-106

Amount (1 Thru 5): **$ 726,200.00**

C. Heating, Ventilation and Air Conditioning - System Replacement

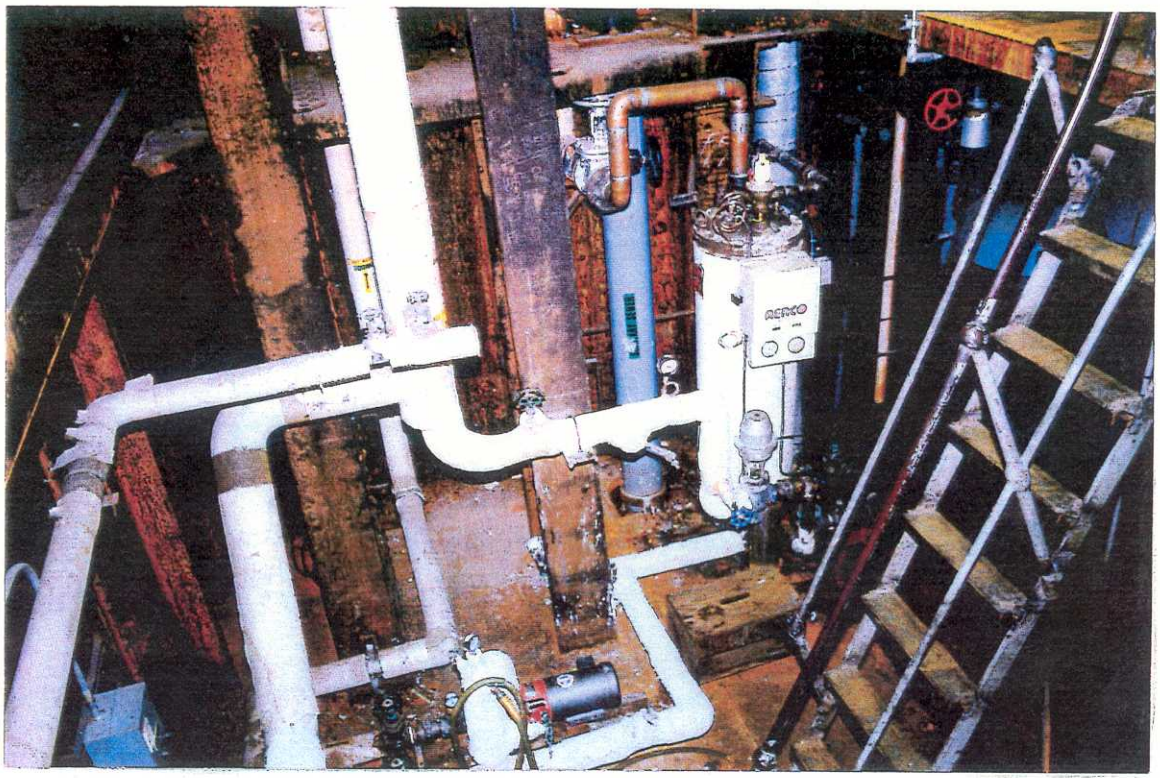
Due to the age of the equipment and limited maintenance performed, a scheduled replacement of the air handlers, fan coil units, supply fans, and exhaust fans should be undertaken within the next 3 to 5 years.

Amount **$ 2,450,000.00**

D. Sewage System

The Ships Sewage is collected throughout the Ship and led to three collection tanks, two located on "F" Deck, Port and Starboard. Each has a capacity of 1870 gallons (250 cu. ft.). Two 500 gpm sewage pumps service each of these tanks. The

third tank is located on "G" Deck at frame 65 centerline and has a capacity of 1197 gallons (160 cu. ft.). This tank is serviced by two 200 gpm pumps which discharge to the Long Beach City sewer system.



**SEWAGE SYSTEM**
**"F" DECK, PORT SIDE**

a) Pumps

Pumps appear to be in good condition, and this is borne out by maintenance personnel. Due to the length of time in use, pumps should be overhauled completely to avoid future problems.

b) Valves

Some sewage system valves show signs of past leaks, others were leaking at the time of inspection, although not seriously. All valves in this system should be refurbished with new gaskets, seats, etc.

c) Piping

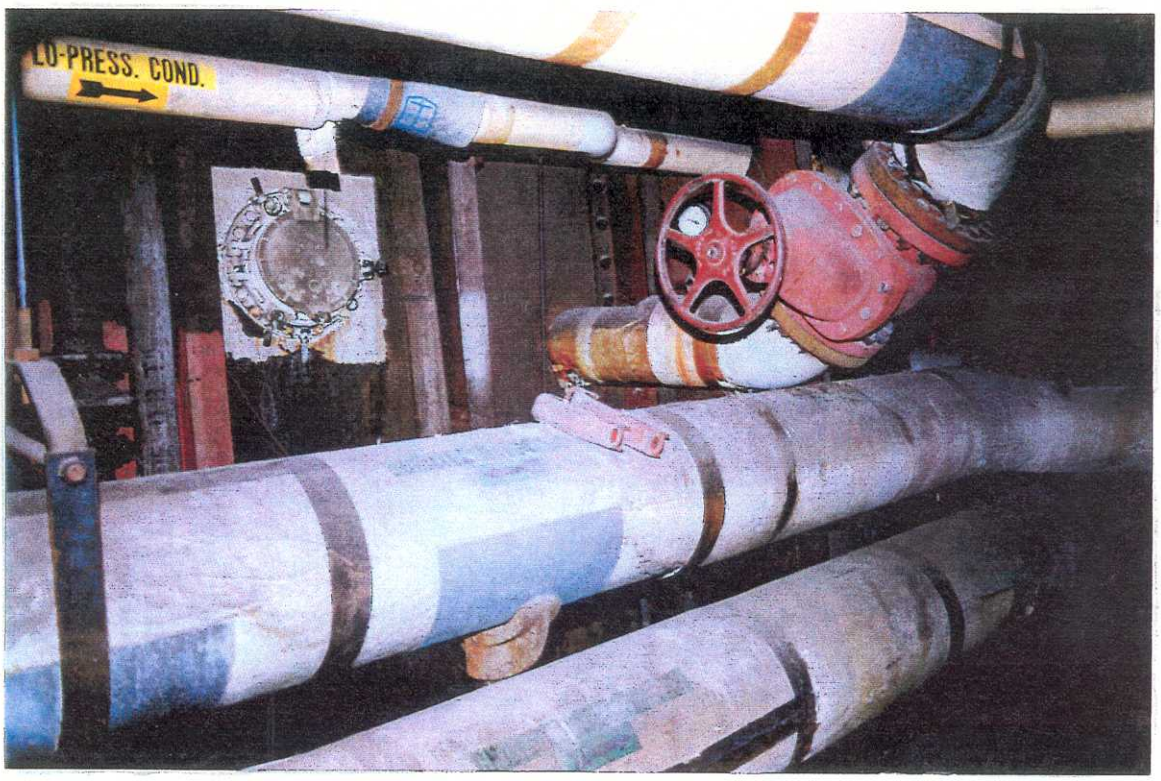
Piping seems to be generally in good condition with a few leaks noted. Some PVC pipe has been replaced with copper pipe. Piping is not

adequately supported by pipe brackets in some areas, particularly in the sewage tank room.

Amount $ 223,000.00

E. Steam System

Steam is supplied to the vessel from two 800 H.P. boilers located in the central energy plant on shore for comfort heating, water heating and some cooking equipment.




**PENETRATION POINT**
**FOR MAIN STEAM LINE ENTERING SHIP**

a) Valves

A large portion of the valves throughout the steam system have either leaks through the bonnet or flanges and have deteriorating or missing insulation. Some valves are "frozen". Balancing valves are generally in poor shape and should be either repaired and calibrated or replaced and calibrated. All valves should be checked for proper operation. Pneumatic valve control tubing should be tested, pressures verified and gages calibrated then re-installed.

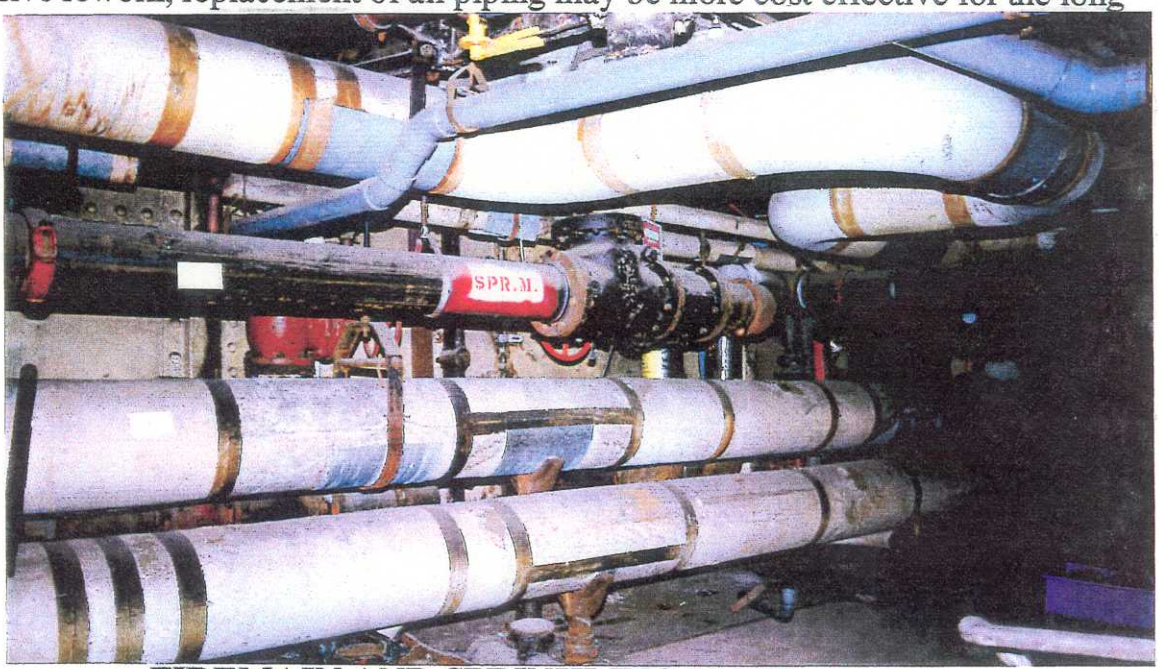
b) Piping

Steam lines not exposed cannot be assessed for wear without removing insulation, but many sections have insulation missing, exposing leaks and extremely corroded conditions. These conditions occur throughout the ship and in various sizes.

Amount $ 150,000.00

F. Firemain System

The Firemain and Sprinkler Systems are served from the shore by separate lines. Both systems after many years of use, should be flushed and hydrostatically pressure tested in their entirety plus perform any other test required by the Long Beach Fire Department. Results of these tests will help determine the condition of the systems and the extent of repairs to be made. Should these tests indicate extensive rework, replacement of all piping may be more cost effective for the long term.




**FIREMAIN AND SPRINKLING MAIN AT POINT OF HULL PENETRATION**

There is presently at least 40 feet of firemain which has developed leaks. This is an indication that further problems will arise in the future, due to the deterioration of the piping.

a) Sprinkler System

Some of the sprinkler heads (approximately 20 percent) are damaged to some extent, and must be replaced. All valves should be checked for leakage and proper operation.

Amount **$ 475,000.00**

b) Replace Firemain System

Due to the age of firemain system and the appearance of water leaks, it is recommended that the firemain be replaced during the next 3 to 5 years. Since the firemain piping penetrates asbestos containing materials, a qualified ACM firm will be required to remove hazardous materials from overhead and side partitions.

Amount **$ 1,950,000.00**

G. Gas Line

The natural gas line serving the Q.M. at present seems to be generally in good condition, but there are some portions on the tower which should be checked by the Gas Company which services the facility.

Amount **$ 5,000.00**

H. Water (Hot/Cold) System

Water is supplied to the vessel from shore via two (2) 6" hoses at "C" Deck. These hoses appear to be in good condition except for an accumulation of marine growth. The hoses should be cleaned and their condition assessed to determine if replacement should be made. A set of spare umbilicals should be made up as specified in part 8 of this report, so that in case of emergency, down time is minimal.

Hot water is served by two Aerco instantaneous water heaters using steam as the heating medium. The piping in the heater spaces appears to be in good condition except for some insulation missing which was being repaired at the time inspection was made.

Water piping is in fair to good condition, but requires a pressure test to locate leaks and defective piping. Control valves not operating properly should be overhauled or replaced. Insulation is missing on some hot water piping.

Amount $ **202,000.00**

I. Bilge System

The Bilge System, consisting of a main line which runs Fore and Aft with branch lines to various areas of the bilges, is served by three (3) pumps, one (1) forward and one (1) amidship, both on the Port side of the vessel, and one (1) Aft on the Starboard side of the vessel. Two emergency diesel pumps are also located on the ship about "G" Deck level, however only one is connected.

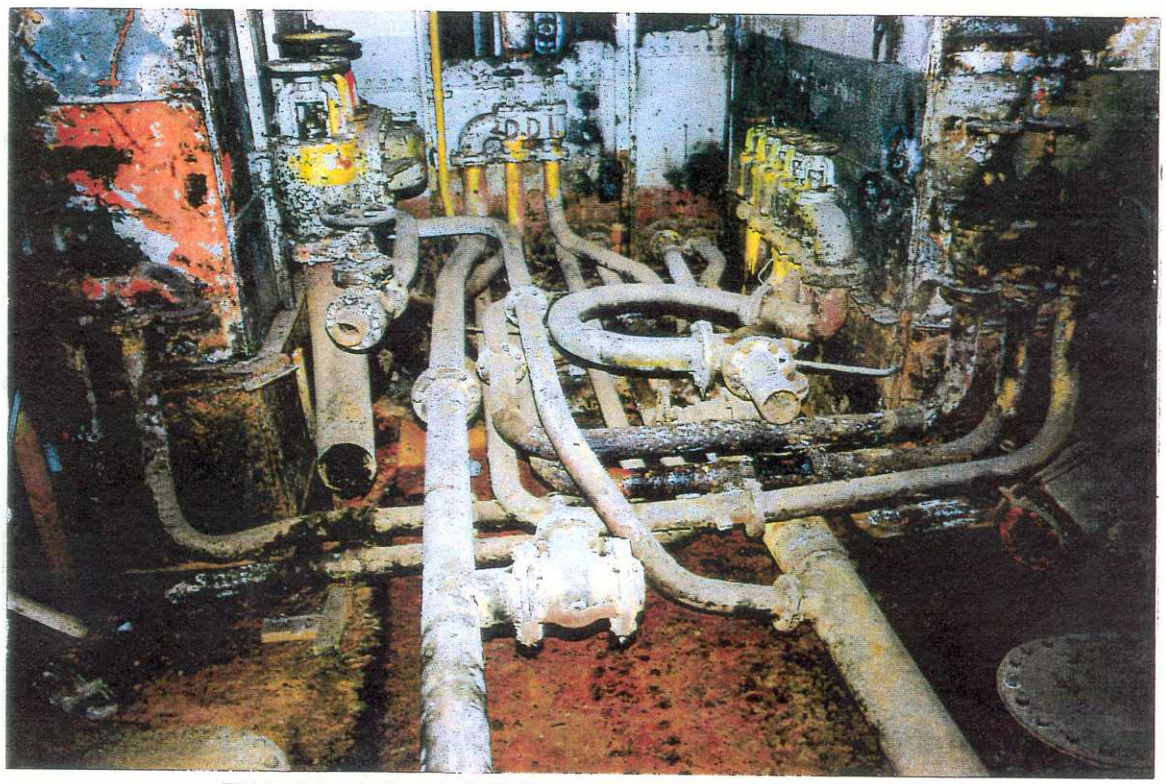
**BILGE PIPING WITH BRANCH LINES TO SUMPS**

a) Pumps

Bilge system pumps (3) have been overhauled and are in good working condition per maintenance people. Rados International Corporation personnel did not observe the pumps in operation. The forward emergency diesel pump at frame 225 is in good condition and is connected to the bilge main and to the ballast system, but a second diesel pump Fwd has not been connected.

b) Piping

Piping installed during the conversion is PVC mixed with steel, and in fair to good condition. All bilge wells are clean and have water to cover the suction strainer. Bilge piping forward of frame 260 is badly corroded, with some sections completely rusted out, making the system inoperative. Some piping has been replaced at some of the bilge wells. Watertight bulkheads which could ordinarily isolate various areas of the bilges are non-existent, subjecting the ship to total flooding in case of a catastrophic disaster.



**PART OF BILGE PIPING SYSTEM**

c) Valves

Bilge suction valves in some areas are "frozen" making them inoperable. All valves must be overhauled to assure they are in proper working order.

Amount $ **283,000.00**

J. Ballast System

The ballast system presently installed on the ship is connected to the bilge main-header and utilizes the bilge pumps to transfer water to and from 12 individual valved wing tanks, 6 starboard and 6 port. However, this system is not being used. Ballasting is accomplished by using a hosed fill line from the ship's Fire Main into the tanks on "D" deck, and drained by gravity to the sea.

The ballast system as it is now connected lacks the flexibility to make it a viable system. This problem can be corrected by adding seven (7) valves and two (2) short lengths of pipe, which would allow transfer to and from any two tanks.

Amount $ **82,000.00**

K. Deck Drains

Inspections have revealed that some deck drains are partially or completely plugged. It is recommended that the drain pipes be cleaned out to insure free flow from point of origin to terminating point. Provide and install strainer plates at scupper intakes to keep out foreign material and debris.

Further investigations show that several drain pipes have rusted through as a result of the corrosive atmosphere. In order to contain this water from overflowing or entering interior bulkheads and/or overheads, it is recommended that these drain pipes be replaced in areas where pipes have rusted through.

Amount $ **60,000.00**

L. Fire Detection System

The Fire Detection System is outdated and parts are no longer available. The system was last tested in 1990 with few problems reported. However, with limited access and reduced maintenance crews, the possibility exists for a fire to go undetected until it can become a threat to the vessel and the lives of tourist or crew.

It is our recommendation that the Fire Detection System be replaced at this time.

Detailed studies would have to be conducted, but calculating on a square foot area, the cost would be approximately

Amount $ **300,000.00**

M. Public Address System

The P.A. System is outdated as the Fire Detection System, and is not in total working order. This system would be necessary to guide people from the vessel in case of an emergency.

It is our recommendation that this system be replaced at this time.

Detailed studies would have to be conducted, but calculating on a square foot area, the cost would be approximately

Amount $ **150,000.00**

N. Miscellaneous

Replacement of the lavatories in the Capstan Club men's restroom.

Spare hoses utilized for the ship to shore umbilicals, should be made in case of rupture of an existing hose. Should that occur, a spare hose can be immediately put into operation without a costly and timely delay occurring.

An inventory of valves, fittings, pipe, belts, motors, filters, etc., which are more likely to be required, should be provided. Input from maintenance personnel can establish the correct inventory.

Amount $ **200,000.00**

# QUEEN MARY
# VESSEL ANALYSIS

## MECHANICAL

## SUMMARY SHEET

| No. Description | Qty | Mat'l | Labor | Immed | Defer | Total |
|---|---|---|---|---|---|---|
| A. H.V.A.C.-Existing Repairs | | 399,700. | 326,500. | 726,200. | | 726,200. |
| B. H.V.A.C.-System Replaced | | | | | 2,450,000. | 2,450,000. |
| C. Sewage System | | 49,000. | 174,000. | | 223,000. | 223,000. |
| D. Steam System | | 45,000. | 105,000. | | 150,000. | 150,000. |
| E. Firemain System | | 100,000. | 375,000. | 475,000. | | 475,000. |
| F. Firemain Replace | | | | | 1,950,000. | 1,950,000 |
| G. Gas Line | | 1,000. | 4,000. | | 5,000. | 5,000. |
| H. Hot/Cold Water | | 40,000. | 162,000. | | 202,000. | 202,000. |
| I. Bilge System | | 63,000. | 220,000. | | 283,000. | 283,000. |
| J. Ballast System | | 27,000. | 55,000. | | 82,000. | 82,000. |
| K. Deck Drains | | 15,000. | 45,000. | | 60,000. | 60,000. |
| L. Fire Detection System | | | | | 300,000. | 300,000. |
| M. Public Address System | | | | | 150,000. | 150,000. |
| N. Miscellaneous | | | | | 200,000. | 200,000. |
| | | | TOTAL | **1,201,200.** | **6,055,000.** | **7,256,200.** |

# Volume III
# SECTION VIII

*QUEEN MARY*

## VESSEL ANALYSIS

## CURRENT
## ELECTRICAL SYSTEMS
## REPORT OF FINDINGS

# QUEEN MARY
# VESSEL ANALYSIS

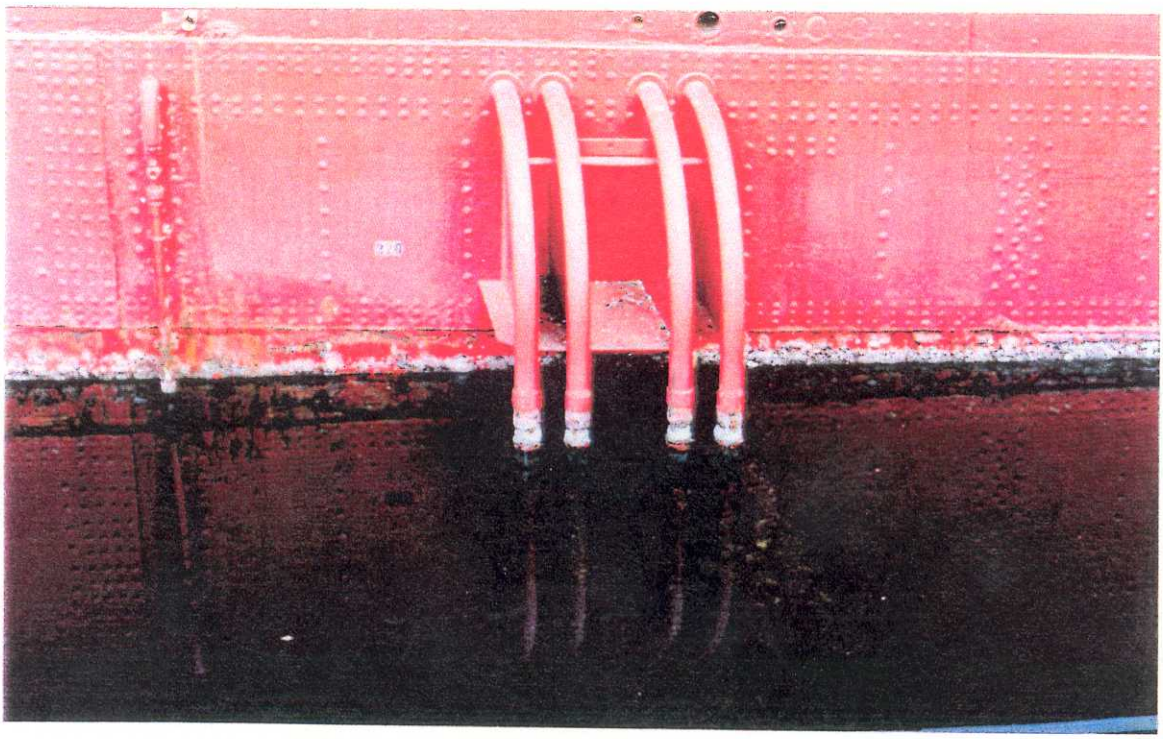
# ELECTRICAL SYSTEM

## INTRODUCTION

The Queen Mary Electrical System was designed and installed by John Brown Shipyards, Clydebank, Scotland during the period of 1934 - 1935. The Ships Generators, Switch-boards, Controllers, Motors and Wiring were designed and installed for direct-current (DC) use. Upon inspection of the Electrical System in 1967, it was determined due to defective wire insulation, wooden distribution boxes, outdated transformers and switchboard panels and aged generators, that the installation of a new electrical systems using alternating-current (AC) aboard the Queen Mary would be required and power use would be provided by Southern California Edison Company.

The feeder lines are connected to two (2) 3750 K.V.A. (Kilo Volt Amp) transformers for a total available capacity of 7500 K.V.A.. These transformers have 12,000 volt primary and 4160 volt secondary capacities.

Power is supplied to the structure at 4160 volts by two (2) main feeders. Each one of the feeders can carry the existing load, thus providing redundancy in the event of failure of one of the feeders.



MAIN ELECTRICAL SUPPLY FEEDERS TO SHIP

At the structure, the voltages are stepped down from 4160 to 480 volts at each of the thirteen (13) transformers.

Electrical Substation No. 2 feeds all equipment connected to the Emergency Power Network in the facility. In the event of shore power failure, emergency power is supplied by a Delco Diesel Generator, 500 K.V.A., 480, 3 phase, 60 HZ Delta connection located on "B" deck at frame 19. The emergency power available is utilized primarily for lighting, but includes four (4) sewage pumps and two (2) bilge pumps.

There is an existing spare 750 K.V.A. transformer available for use in the event of failure of existing transformers.

## ASSUMPTIONS AND LIMITATIONS

1. The current connected power (available power) for the facility is 7500 KVA (Kilo Volt Amp).

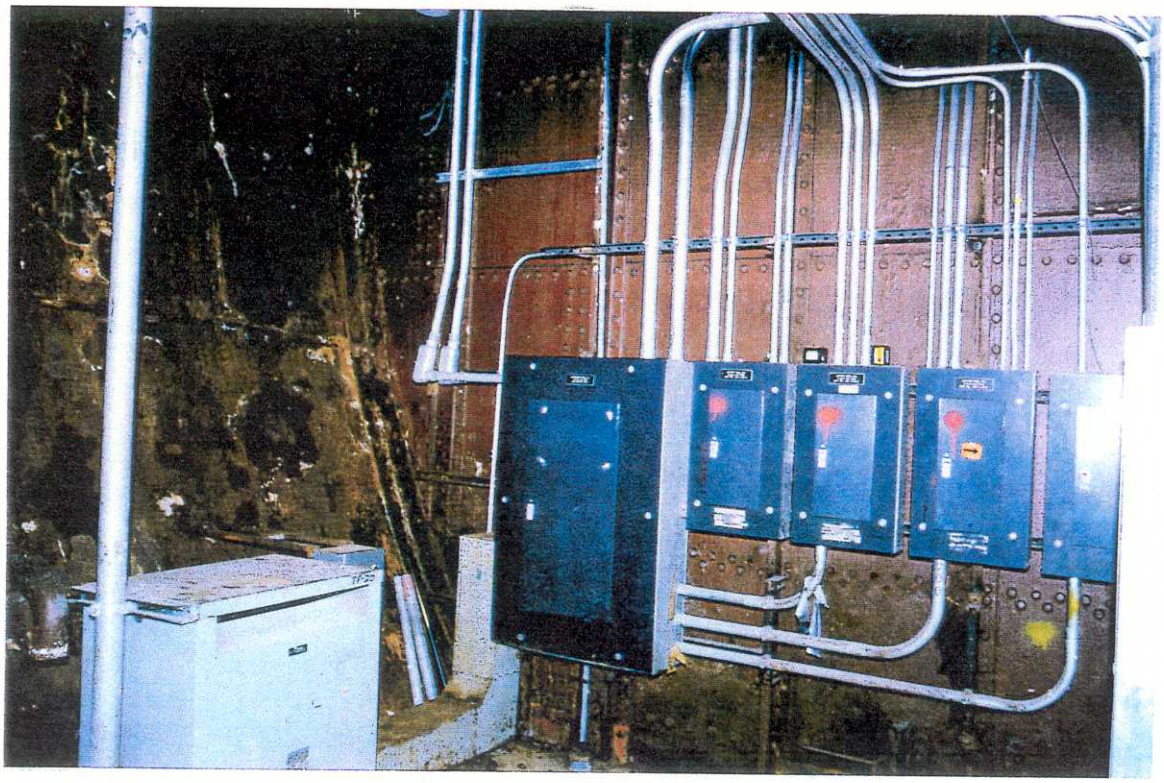
2. The current demand of the facility, taken from reports aboard the vessel, is approximately 2039 KVA or 27% of the total connected capacity.

3. The field research for this report did not include verification of connections for cables or busbars made in the main distribution panels, distribution panels and cable to cable.

## CONCLUSION

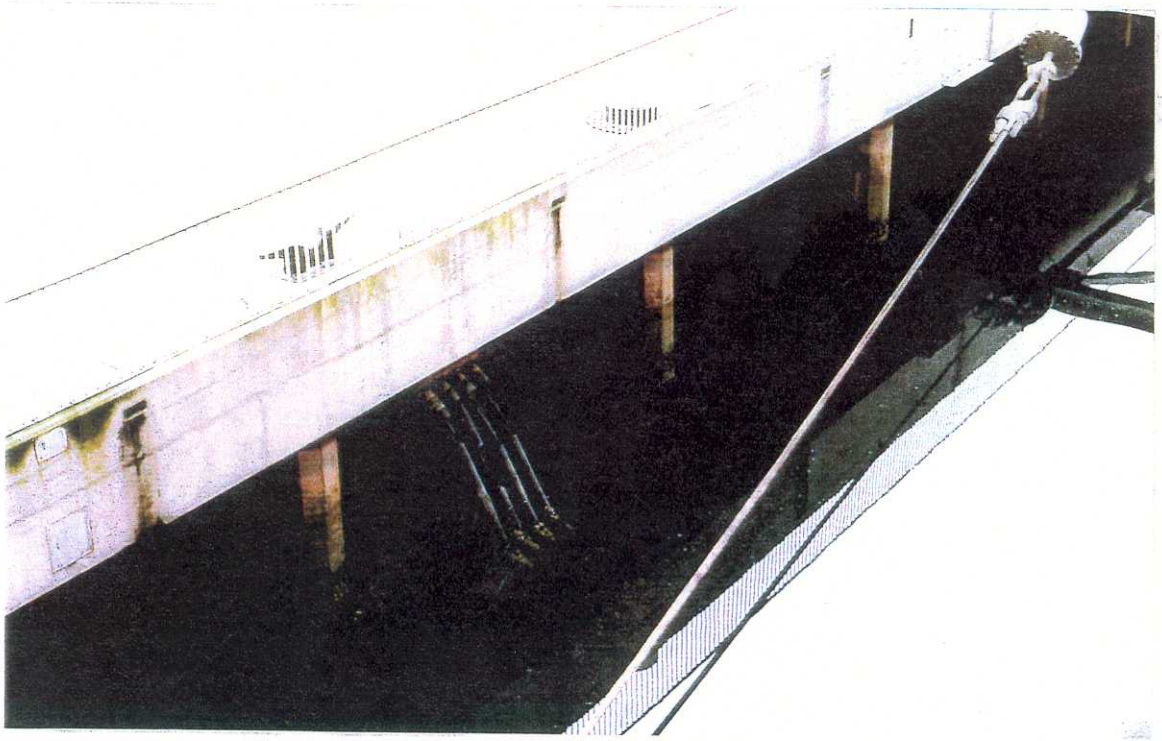
An important goal of the electrical survey was to verify the existance of proper protective devices on the system. Equipment that cannot withstand or interrupt excessive loads, is subject to damage or destruction and poses a threat to surroundings.

Investigations revealed that most of the equipment has the proper overcurrent ratings on the protective devices. Also, there are ground fault indicators throughout the facility which in general are operational. These indicators allow identification of those distribution panels with current leakage that need to be maintained or repaired.



TRANSFORMER, DISTRIBUTION AND POWER PANEL

Power is supplied to the Ship by Southern California Edison. These power lines are under utilized at the present and, additional loads can be accommodated with modifications or additional expense.



PIER SIDE ELECTRICAL MAIN FEEDERS
FEEDING SHIP

The maximum load on any of the thirteen (13) substation transformers located at the facility do not exceed 30% of their capacity. At the present there is no demand charge (fee for under utilizing equipment). However, this condition could change at the discretion of SCE. Should demand charges be required in the future, modifications to the electrical distribution system would be recommended to minimize charges.

Some of the equipment associated with each substation includes:

1) Distribution panel boards
2) Transformers
3) Disconnects
4) Circuit Breakers
5) Capacitors
6) Cables
7) Conduit
8) Motors

In general the electrical equipment is approximately (20) twenty years old and in fair condition. However, the main breaker at each of the thirteen (13) load centers are no longer manufactured. Finding parts for replacement is difficult. We recommend the replacement of all the main breakers.

Most of the breakers have not been tested internally to ensure proper operation when needed. We recommend infrared testing and mechanical testing for breakers 200 AMPS or larger.

The existing emergency generator should be tested under a full load condition to ensure proper operation when needed.

All of the electrical rooms have only one exit. We recommend the installation of an additional exit at each location housing a main distribution panel in order to provide an alternate exit as required by code.

Some of the most frequent problems encountered throughout the facility are:

a) Inadequate lighting - 70 locations
b) Oversized breakers - 10 locations
c) Exposed connections - 4 locations
d) Deteriorated equipment - 6 locations
e) Equipment inaccessibility - 10 locations

A. Electrical System Repairs:

1. Emergency Generator service, repair and check-out.

Amount $ 15,000.00

2. Install a second exit in all electrical rooms.

Amount $ 7,575.00

3. The following list describes the deficiencies, categorized by substation.

A. Substation No. 1 L.C. B-114-2
- Replace main circuit breaker
- Setting on main circuit breaker is 1600 A. Reset to 800 A.

B. Substation No. 2 L.C. B-19-2E (Emergency)
- Replace main circuit breaker
- Complete Emergency system test
- Panel 1319 "S" Deck - service area around unit
- Panel 1323 "C" Deck - panel lighting

C. Substation No. 3 L.C. A-112-2
- Replace main circuit breaker
- Panel 715 "R" Deck - panel lighting

D. Substation No. 4 L.C. B-112-2
- Replace main circuit breaker

E. Substation No. 5 L.C. F-85-2
- Replace main circuit breaker
- Panel 523, 523B, 526 & 527 poor condition, replace
- Lighting at panels, 8 locations
- Panel 510 is not accessible

F. Substation No. 6 L.C. S-107-2
- Replace main circuit breaker
- Substation in poor physical condition, refurbish

- One oversized circuit breaker, replace
- Lighting at panels, 9 locations
- Ventilation at panel 1227 and 1240

G. Substation No. 7 L.C. M-100-1
- Replace main circuit breaker
- Panel 604, 200 AMP circuit breaker, 135 AMP wire
- Lighting at panels, 10 locations

H. Substation No. 8 L.C. F-165-2
- Replace main circuit breaker
- Lighting at panels, 6 locations

I. Substation No. 9 L.C. M-230-1
- Replace main circuit breaker
- Circuit breaker ratings panel 363 & 386, replace
- Lighting at panels, 12 locations

J. Substation No. 10 L.C. B-19-2
- Replace main circuit breaker
- Service area around panel 1319
- Lighting at panels, 5 locations

K. Substation No. 11 L.C. P-143-1
- Replace main circuit breaker
- Circuit breaker ratings, 4 locations, replace
- Panel 1124, poor physical condition

L. Substation No. 12 L.C. SP-202-2
- Replace main circuit breaker
- Service area around panels, 4 locations
- Lighting at panels, 13 locations
- Ventilation, panel 114

M. Substation No. 13 L.C. R-241-2
- Replace main circuit breaker
- Circuit breaker rating, panel 241, replace

- Exposed connections, 3 locations
- Lighting at panels, 6 locations
- Service area around panel, 2 locations

Amount $ 98,825.00

The maintenance aboard the vessel is ongoing and some items listed above may have been corrected by the time the Port of Long Beach reaches a decision as to the disposition of those items. However, the information in this report is accurate at the time of the investigation on the vessel.

## ESTIMATED COSTS (MODIFICATIONS AND REPAIRS)

The following pages contain the estimated costs to accomplish the necessary modifications and repairs.

The large majority of repairs fell into a finite number of similar repair type requirements allowing several portions of the scope to be estimated with general allowance type costs. Specialized repairs were treated separately.

This estimate was prepared without the benefit of any formalized engineering such that scope assumptions had to be employed as to layout, method, material specifications and setup.

Estimating unit manhour productivity was derived with consideration for the fact that the work is to be performed in discrete locations separated in space such that production type installation is impossible.

Some basic assumptions are as follows:

- Lighting fixture additions will intercept existing circuits.
- Improperly sized circuit breakers shall be replaced.
- Inadequately ventilated electrical rooms will have exhaust fans installed.
- Load center main circuit breaker replacements will be Westinghouse molded case type.

# QUEEN MARY
# VESSEL ANALYSIS

## ELECTRICAL

## SUMMARY SHEET

| No. | Description | Qty | Mat'l | Labor | Immed | Defer | Total |
|---|---|---|---|---|---|---|---|
| 1. | Emergency Generator Repair and Service | | 5,000. | 10,000. | 15,000. | | 15,000. |
| 2. | Electrical Sub-Stations and Auxiliaries | | 65,900. | 32,925. | 98,825. | | 98,825. |
| 3. | Second Exits in Electrical Rooms | | 3,575. | 4,000. | | 7,575. | 7,575. |
| | | | | **TOTAL** | **113,825.** | **7,575.** | **121,400.** |

# Volume III
# SECTION IX

*QUEEN MARY*

**VESSEL ANALYSIS**

## MAINTENANCE COSTS FOR THE HULL STRUCTURE, MECHANICAL AND PIPING SYSTEMS, AND ELECTRICAL SYSTEMS

# QUEEN MARY
# VESSEL ANALYSIS

# VESSEL MAINTENANCE

## INTRODUCTION

The importance of an established preventative maintenance program is an area that cannot be overstated. During the years of operation following the conversion there was some confusion between the leasee and the City/Port regarding maintenance responsibility. This confusion and the lack of a definitive maintenance schedule caused the general deterioration of the vessel.

This condition eased somewhat after the Disney Corporation acquired the lease of the facilities, a maintenance program was established and many needed repairs were performed. However, even an efficient repair and maintenance program cannot overcome numerous years of neglect. As a result, a major renovation program is required to upgrade these systems and structure that have received little attention before a maintenance program can be effective.

The purpose of this section is to address those areas requiring consideration in developing a preventative maintenance program. The items listed in this section represent some of the items which must be incorporated into the program, but does not represent a complete list.

In the outline of a maintenance program, it has to be assumed that at least some of the items of renovation have been completed, since a maintenance program cannot effectively deal with the labor and logistics of major renovations or improvements.

It should be pointed out that the deterioration rate of a structure floating in salt water, with all interior areas open and subject to the effects of the salt water environment, is not significantly different from that of an operating vessel. The major difference being that an operating vessel has a large crew that maintains the vessel around the clock.

Based upon the existing conditions and uses aboard the Queen Mary structure, the following maintenance cost for Hull Structure, Machinery, Piping, and Electrical Systems are as follows:

## HULL AND STRUCTURAL MAINTENANCE

Maintenance of the hull, internal structural members, bulkheads, deck plating, wood paneling, wood decking, and inspection of rigging, utilizes both a scheduled maintenance and a mandatory periodic visual inspection of all exposed surfaces and structures which are non-mechanically and non-electrically related.

During the construction of the vessel which began in 1931, the creation of thousands of compartments both large and small were constructed within the shell of the hull and the superstructure. Many of these compartments have been neglected especially in the lower and after sections of the vessel.

Maintenance of the structural portion of the vessel is comprised mainly of re-painting of the steel and wood elements of the ship and in some cases, sandblasting or hydroblasting prior to the recoating. In view of the square footage located between the thirteen (13) decks and including the exterior masts, funnels, deck equipment and life boats, the task is significant in scope. The maintenance of the painting and upkeep of the loading ramps and gangways, the breasting structures, mooring lines/cables and visual inspections of the cathodic protection system including readings from it's six rectifiers are included in the maintenance program.

Included in the hull maintenance is the lubrication of staying wires and cables, tightening of loose nuts and bolts, removal of debris, replacement of defective overhead panels, and the ordering and stocking of appropriate maintenance materials.

Prior to any repairs to machinery, piping, or electrical systems, the hull maintenance group might be required to remove existing panels or like interferences in order to allow the mechanical and electrical maintenance groups to perform their maintenance tasks.

In determining the maintenance cost for the Hull and Structure Group, it is assumed that all the immediate and deferred items listed in Section VI are completed and therefore the following minimum amount of labor and materials are required.

| | | |
|---|---|---|
| LABOR | $ 600,000.00 | |
| MATERIAL | $ 1,425,000.00 | |
| | TOTAL | **$ 2,025,000.00** |

If the immediate and deferred items are ***not*** completed the maintenance cost would be as follows:

| | | |
|---|---|---|
| LABOR | $ 1,261,850.00 | |
| MATERIAL | $ 2,788,150.00 | |
| | TOTAL | **$ 4,050,000.00** |

## MECHANICAL SYSTEM MAINTENANCE

All mechanically operated system components and devices must be serviced periodically on a scheduled basis to insure the accurate, dependable and satisfactory performance required of the components and controls. Proper operating condition of components and systems, affects not only the system's operation but more importantly the useful life of the component. Because of the salt water environment, some items need more frequent attention, especially those open to the weather.

The large amounts of mechanically operated system components aboard the Queen Mary along with the varied types and sizes of units, present a tremendous maintenance challenge. Practically all spaces of the 1,018' long by 118' wide vessel, along with the thousands of compartments located within the thirteen (13) decks, contain serviceable system components.

Those emergency systems that affect the safety of personnel aboard the vessel such as the Fire Protection System and the Public Address System, require special attention so that in case of emergency, the prevention of injury and the loss of life is minimized. The successful performance of emergency related systems in actual emergencies, provides psychological comfort to guest and personnel and limits the legal exposure to owners and operators. Other mechanical systems such as the Environmental Control System (ECS), the Sewage System and the Compressed Air System while vitally as important for the successful day to day operation, do not demand the high degree of responsibility and accuracy of system maintenance.

In implementing an effective maintenance program, it is essential that responsible maintenance be performed by knowledgeable, qualified, and dedicated maintenance personnel. Many problems that are encountered are the result of responsible maintenance decisions as opposed to lack of system knowledge.

The following systems and their components require scheduled maintenance and system testing as required by the manufacturer of each system component which obviously vary, and comprise the estimated costs as follows:

a). Firemain & Sprinkling System and Alarm System
b). Valves & Piping
c). Bilge System
d). Sewage System
e). Compressed Air System
f). Environmental Control System (HVAC)

1. Chill Water System
2. Steam System
3. Pneumatic Controls/Actuators
4. Air Handling
5. Fan Units
6. Compressors/Condenses

g). Hot and Cold Fresh Water System
h). Public Address System

Prior to any repairs to the machinery, piping systems, the hull maintenance group would be required to remove wood paneling and like interferences to allow the mechanical maintenance group to perform their maintenance tasks. The group would also be required to order and stock appropriate maintenance materials. The testing and inspection of all systems is included.

In determining the maintenance cost for the Mechanical Group, it is assumed that all the immediate and deferred items listed in Section VII are completed and therefore the following minimum amount of labor and materials are required:

| | | |
|---|---|---|
| LABOR | $ 817,825.00 | |
| MATERIAL | $ 1,952,333.00 | |
| | TOTAL | **$ 2,770,158.00** |

If the immediate and deferred items are ***not*** completed the maintenance cost would be as follows:

| | | |
|---|---|---|
| LABOR | $ 2,523,710.00 | |
| MATERIAL | $ 3,016,260.00 | |
| | TOTAL | **$ 5,540,000.00** |

## ELECTRICAL ESTIMATED COSTS

The following list represents the minimum required maintenance for the electrical system and components. As a developing Preventative Maintenance Program is initiated, items pecular to a specific vessel will arise and should be added to the Maintenance Program. This list is derived from industry practice and ANSI/IEEE recommended practice and is comprised of the following:

ANNUAL

- Circuit breaker cleaning, testing, inspection and tightening.
- Emergency generator for full load 2 hr test.
- Infrared testing of circuit breaker loading.

TRI-ANNUAL

- Circuit breaker cleaning, testing, inspection and tightening.
- Emergency generator full load 2 hr. test.
- Infrared testing of circuit breaker loading.
- Ground detector light functional check.
- Ground resistance continuity check.
- Test Transformer Insulation (duble testing).
- Conductor insulation testing.
- Motor control center checkout and large motor overload tests.

The estimated costs for all of the above maintenance was derived from documents and report aboard the vessel. Circuit breaker detailed testing, is to be performed on all breakers 200 AMPS and larger. Cleaning and visual inspection will be performed on all circuit breakers on a load center basis.

Test and inspection prices were derived from documents and reports aboard the vessel.

| | |
|---|---|
| LABOR | $ 38,175.00 |
| MATERIAL | $ 20,000.00 |
| TOTAL | $ **58,175.00** |

# QUEEN MARY
# VESSEL ANALYSIS

## MAINTENANCE COSTS

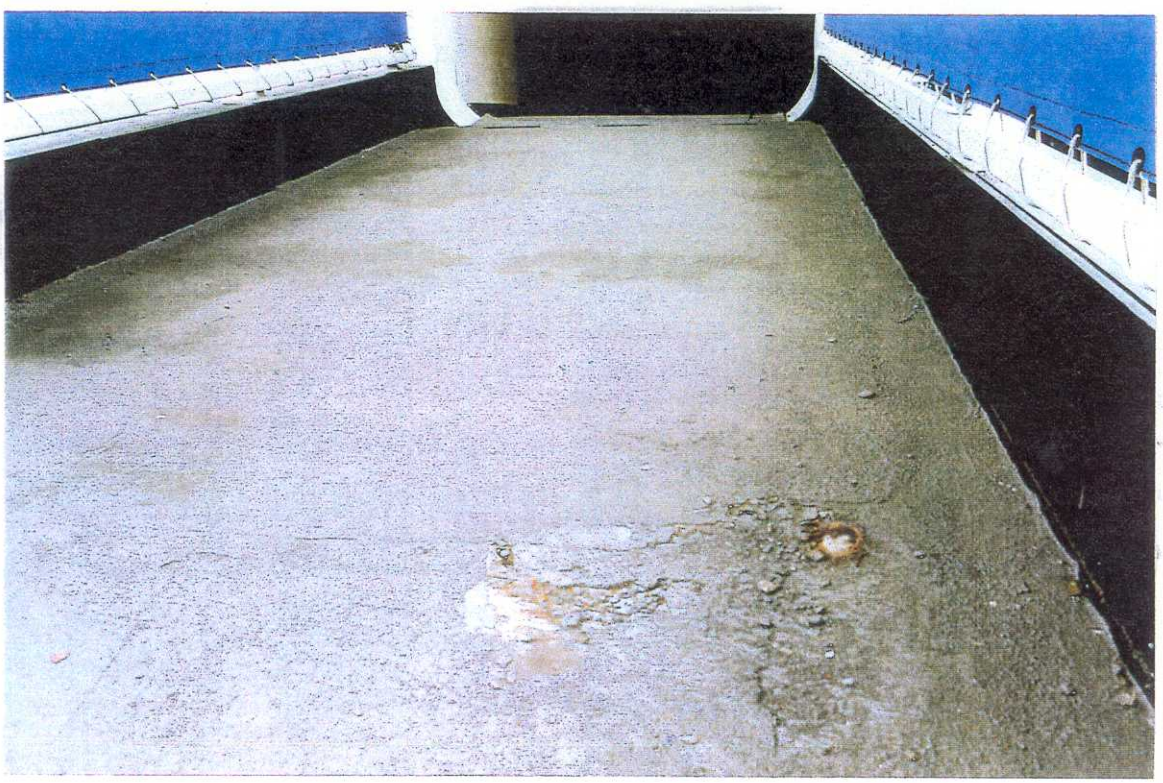
## SUMMARY SHEET

| No. | Description | Qty | Material | Labor | Total |
|---|---|---|---|---|---|
| 1. | Hull Structure | | 1,425,000.00 | 600,000.00 | 2,025,000.00 |
| 2. | Mechanical Piping Systems | | 1,952,333.00 | 817,825.00 | 2,770,158.00 |
| 3. | Electrical System | | 20,000.00 | 38,175.00 | 58,175.00 |
| **TOTAL** | | | **3,397,333.00** | **1,456,000.00** | **4,853,333.00** |

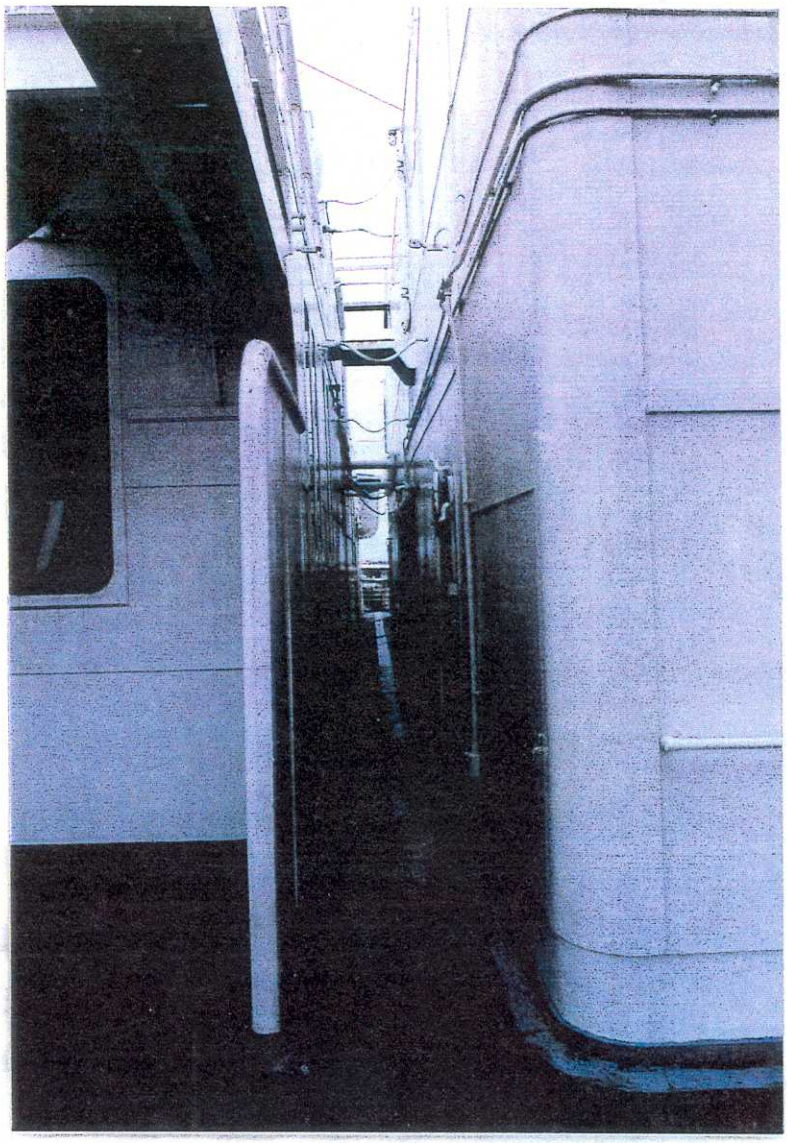
Maintenance is by nature, "Deferred", however ignored maintenance will become major repair items later.

The Material costs listed above, include those items for which outside contractors must be used.


MOORING LINES/CABLES



EMERGENCY EXIT GANGWAY



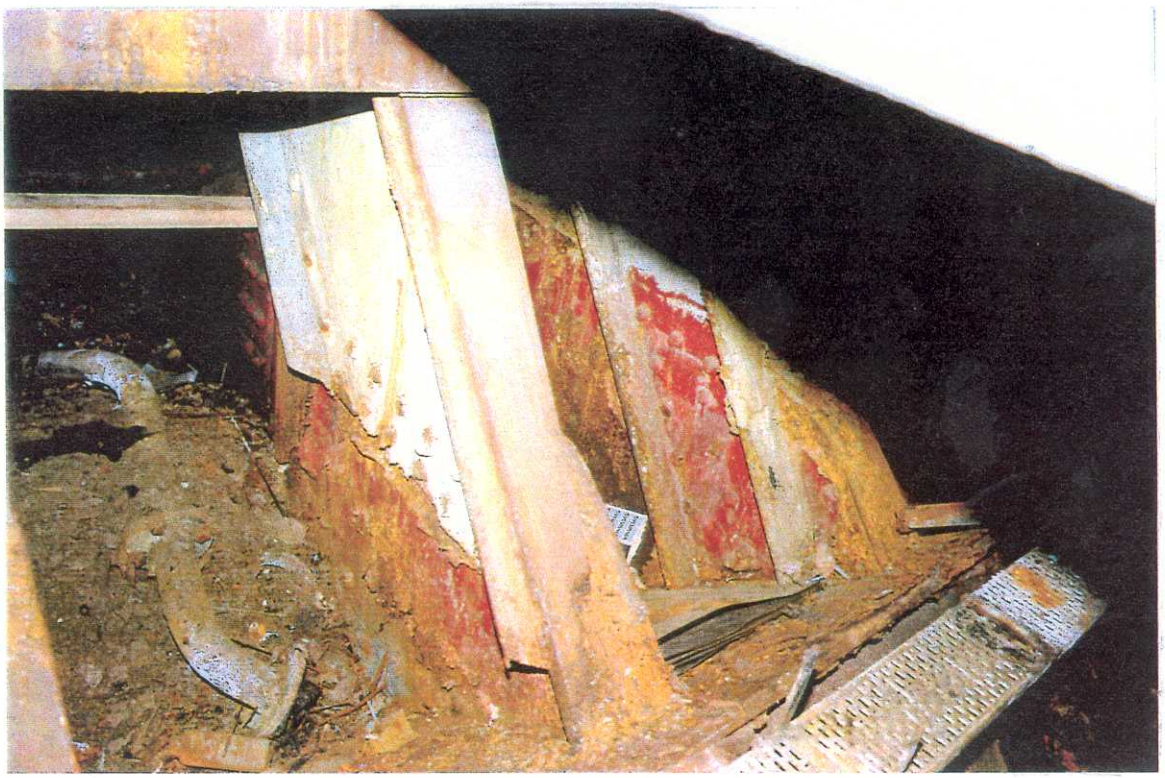
TYPICAL
EXPANSION
JOINT

"R" DECK
PASSAGEWAY
PORT SIDE

FUNNEL No.1 UPTAKE - "D" DECK, PORT SIDE

PASSAGEWAY, "F" DECK TO "E" DECK, POST SIDE, AFT

BILGE AREA, PORT SIDE, AFT



SHAFT BILGE AREA, STBD SIDE

# Volume III
# SECTION X

## *QUEEN MARY*

## VESSEL ANALYSIS

## ALTERNATIVE USES FOR THE QUEEN MARY

# QUEEN MARY
# VESSEL ANALYSIS

## ALTERNATE USES

Economics Research Associates has been authorized by the City of Long Beach to develop alternative use concepts for the Hotel Queen Mary complex. Rados International Corporation has investigated the following concepts and are submitting a rough order of magnitude for design and construction.

**Alternative No. 1** Night-time Entertainment Center

**Alternative No. 2** Card Club Combined with Entertainment Center

**Alternative No. 3** Shore Based Maritime Museum with Mini-Tour of Ship

The following narrative on the revised alternative uses is separated into the three options as listed above. The "fit-out" would include: interior finishes, floors, walls, ceilings, all furnishing, fixtures, equipment, and props and dressings. These cost estimates were provided by entertainment cost consultant David Holtz. The "structural" would include those costs to develop the area to be fitted.

**Alternative No. 1 Night-Time Entertainment Center**

1. The Observation Lounge would be converted into a 4600 square foot Music Club, Jazz. No structural changes are required. Engineering services required.

| | |
|---|---|
| A. Engineering Services | $ 4,500. |
| B. Fit-Out: (Holtz) | $ 460,000.00 |
| TOTAL | $ **464,500.00** |

2. The Queen's Lounge would be converted into a 4600 square foot dinner theater. The wood paneling and dommed ceiling are far too unique and will not be changed. There will be no structural changes required.

| | |
|---|---|
| A. Engineering Services | $ 2,000.00 |
| B. Fit-Out: (Holtz) | $ 480,000.00 |
| TOTAL | **$ 482,000.00** |

3. The Royal Salon, combined with the King's View Room would be converted into a 4000 square foot sports bar.

   A. Structural changes to remove 33-42 feet of bulkhead and between the two spaces.

   This bulkhead is a primary structural member and therefore, it will be replaced with a longitudinal girder and retain the two web frame supports.

| | |
|---|---|
| Material | $ 5,000.00 |
| Labor | $ 20,000.00 |
| A. Total | $ 25,000.00 |
| B. Fit-Out: (Holtz) | $ 500,000.00 |
| TOTAL | **$ 525,000.00** |

4. The Wedding Chapel, combined with the Victorian Room would be converted into a 3300 square foot Magic Club.

   A. Structural Changes to remove 30 feet of bulkhead between the two spaces.

   This bulkhead is a primary structural member and therefore, it will be replaced with a longitudinal girder and retain the web frame supports.

| | |
|---|---|
| Material | $ 4,000.00 |
| Labor | $ 19,000.00 |
| A. Total | $ 23,000.00 |
| B. Fit-Out: (Holtz) | $ 363,000.00 |
| TOTAL | **$ 386,000.00** |

5. The Prom Cafe and Lounge, 4100 square feet, will be retained but the theme and decor will be changed.

| | |
|---|---|
| A. Engineering Services | $ 3,850.00 |
| B. Fit-Out: (Holtz) | $ 600,000.00 |
| TOTAL | **$ 603,850.00** |

6. The Chelsea Restaurant, 2000 square feet, would be retained but the theme and decor will be changed.

| | |
|---|---|
| A. Engineering Services | $ 2,000.00 |
| B. Fit-Out: (Holtz) | $ 300,000.00 |
| TOTAL | **$ 302,000.00** |

7. The Brittania Salon would be converted into a 9000 square foot Comedy Club.

| | |
|---|---|
| A. Engineering Services | $ 4,500.00 |
| B. Fit-Out: (Holtz) | $ 990,000.00 |
| TOTAL | **$ 994,500.00** |

8. The Veranda Grill would be converted into a 4000 square foot Music and Dance Club.

| | |
|---|---|
| A. Engineering Services | $ 2,500.00 |
| B. Fit-Out: (Holtz) | $ 400,000.00 |
| TOTAL | **$ 402,500.00** |

9. The Sun Deck Museum Area, 15000 square foot, will be retained. About 10% of the display area and displays will be changed. Renovate all displays, clean and paint area.

**$ 200,000.00**

10. The Sir Winston Room, 3500 square foot, will be retained and refit.

| | | |
|---|---|---|
| A. Engineering Services | $ 5,000.00 | |
| B. Refit, Refresh, Interior Decor | $ 75,000.00 | |
| Upgrade Kitchen Equip & Paint | $ 75,000.00 | |
| | TOTAL | $ **155,000.00** |

11. Promenade Deck Retail Shops (11,000 square feet).
    - Retain Shops in Piccadilly Circus
    - Enlarge Shops, Port Side, with displays and doors to Promenade Deck.

    a) "Royal Insignia" (men's store) and "Bit of Britain" (souvenir shop) have been enlarged and are open to the promenade.

    b) "Royal Crystal" shop can be enlarged by deleting bulkheads at frame 243 and 246 to include the spaces now used as a men's restroom and an unassigned office.

    Note: A large vent trunk (approx 6' x 6') penetrating through should not be disturbed.

    Enlarge the door opening to the promenade at frame 241.

    Replace door at frame 247 with display window and add two more windows to frame 250.

    Add display windows to promenade between frames 236-239, to passage between frames 243-246.

    New shop area (including existing storage) approximately 925 square feet. (Net gained; about 350 square feet)

| | | |
|---|---|---|
| A. Structural Mods | $ 60,000.00 | |
| B. Basic Interior | $ 30,000.00 | |
| (Not including Tenant improvement) | | |
| | TOTAL | $ **90,000.00** |

12. Enlargement options - Add 300 square feet of dining to Sir Winston Room. Aft, outboard, corner, port and starboard of this space, there are bulkheads around the mast shrouds. This space, port and starboard, could be opened up for use by shortening the shrouds and re-attaching to new chain plates on the extended deckhouse structure.

| | | |
|---|---|---|
| A. | Srtuctural/Rigging | $ 75,000.00 |
| B. | Fit-Out: | $ 75,000.00 |

TOTAL $ **150,000.00**

**GRAND TOTAL: $ 4,949,550.00**

**Alternative No. 2 - Card Club combined with Entertainment Center.**
The items listed in Alternative No. 1 would be the same for this alternative with the exception of item No. 1, the Observation Lounge would be converted into a Comedy Club and No. 6 the Brittania Salon would be converted into a Card Club. The following is a list of only those changed items.

1. The Observation Lounge would be converted into a 4600 square foot Comedy Club. No structural changes are required.

| | | |
|---|---|---|
| A. | Engineering Services | $ 5,000.00 |
| B. | Fit-Out: (Holtz) | $ 506,000.00 |

TOTAL $ **511,000.00**

6. The Brittania Salon would be converted into a 9000 square foot Card Club.

| | | |
|---|---|---|
| A. | Engineering Services | $ 10,000.00 |
| B. | Fit-Out: (Holtz) | $ 1,080,000.00 |

TOTAL $ **1,090,000.00**

**Alternative No. 3 - Maritime Museum Ashore with Mini-Tour on the vessel.**

| | | |
|---|---|---|
| A. | Engineering Services | $ 6,000.00 |
| B. | Re-Fit | $ 44,000.00 |

TOTAL $ **50,000.00**

The configuration of the Queen Mary to be modified to incorporate the following alternative uses.

**Alternative No. 1** Night-time Entertainment Center

| | |
|---|---|
| Amount | $ 4,809,550.00 |
| With Enlargment Option | $ 4,959,550.00 |

**Alternative No. 2** Card Club Combined with Entertainment Center

| | |
|---|---|
| Amount | $ 4,939,550.00 |
| With Enlargment Option | $ 5,089,550.00 |

**Alternative No. 3** Shore Based Maritime Museum with Mini-tour of Ship

| | |
|---|---|
| Amount | $ 50,000.00 |

# QUEEN MARY
# VESSEL ANALYSIS

## ALTERNATE USES

## SUMMARY SHEET

| No. | Description | Engr | Structural | Fit-Out | Total 1 | Total 2 |
|---|---|---|---|---|---|---|
| 1. | Observation Lounge<br>Music Club, Jazz | 4,500.00 | | 460,000.00 | 464,500.00 | |
| 2. | Queen's Lounge<br>Dinner Theater | 2,000.00 | | 480,000.00 | 482,000.00 | 482,000.00 |
| 3. | Royal Salon<br>Sports Bar | | 25,000.00 | 500,000.00 | 525,000.00 | 525,000.00 |
| 4. | Wedding Chapel<br>Magic Club | | 23,000.00 | 363,000.00 | 386,000.00 | 386,000.00 |
| 5. | Prom Cafe & Lounge<br>Theme | 3,850.00 | | 600,000.00 | 603,850.00 | 603,850.00 |
| 6. | Chelsea Restaurant<br>Theme | 2,000.00 | | 300,000.00 | 302,000.00 | 302,000.00 |
| 7. | Brittania Salon<br>Comedy Club | 4,500.00 | | 990,000.00 | 994,500.00 | |
| 9. | Sun Deck Museum<br>Renovate | | | | 200,000.00 | 200,000.00 |
| 10. | Sir Winston Room<br>Renovate | 4,200.00 | | 200,000.00 | 204,200.00 | 204,200.00 |
| 11. | Prom Deck Retail<br>Add and Renovate | | 60,000.00 | 30,000.00 | 90,000.00 | 90,000.00 |
| | | | | | | |

*Continued Next Page*

| No. | Description | Engr | Structural | Fit-Out | Total 1 | Total 2 |
|---|---|---|---|---|---|---|
| 1. | Observation Lounge<br>Comedy Club | 5,000.00 | | 506,000.00 | | 511,000.00 |
| 7. | Brittania Salon<br>Card Club | 10,000.00 | | 1,080,000.00 | | 1,090,000.00 |
| | | | **TOTAL** | | **4,605,350.00** | **4,735,350.00** |
| | **OPTION-**<br>Enlarge Sir Winston Room | | 75,000.00 | 75,000.00 | | **150,000.00** |

# Volume III
# APPENDIX "A"

*QUEEN MARY*

**VESSEL ANALYSIS**

**SUPPORT MATERIAL**
**FOR**
**HULL and STRUCTURE**
**MACHINERY and PIPING**
**ELECTRICAL**

# *Economics Research Associates STUDY TOTALS*

| *SECTION* | *DESCRIPTION* | *IMMEDIATE* | *DEFERRED* | *TOTAL* |
|---|---|---|---|---|
| I | Summary | 0.00 | 0.00 | 0.00 |
| II | Inrtoduction To Rados Intl corp | 0.00 | 0.00 | 0.00 |
| III | History of Queen Mary | 0.00 | 0.00 | 0.00 |
| IV | Analysis of Sept 26, 1990 Study | 2,095.00 | 1,850.00 | 3,945.00 |
| V | Analysis of Dec 1990 Study | 2,734,425.00 | 288,250.00 | 3,022,675.00 |
| VI | Hull Analysis and Report of Findings | 674,500.00 | 14,766,500.00 | 15,441,000.00 |
| VII | Mechanical and Piping Report of Findings | 1,201,200.00 | 6,055,000.00 | 7,256,200.00 |
| VIII | Electrical Report of Findings | 113,825.00 | 7,575.00 | 121,400.00 |
| | | **$4,726,045.00** | **$21,119,175.00** | **$25,845,220.00** |
| | | | | |
| | | | | |
| IX | Maintenance Costs | Per Year | **4,853,333.00** | **4,853,333.00** |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | *ENLARGE OPTION* | *ALTERNATIVE 1* | *ALTERNATIVE 2* |
| X | Alternative Uses | **$150,000.00** | **$4,809,550.00** | **$4,939,550.00** |

# *HULL and STRUCTURE*

| *No.* | *DESCRIPTION* | *Qty* | *Units* | *Mat'l* | *Labor* | *Total* | *Remarks* |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | **Deck Buckling "A" Deck** | | | | | | |
| 1 | Install Stanchion | | | 1,000 | 1,095 | 2,095 | |
| | | | | | | | |
| | *TOTAL* | | | | | ***$2,095*** | |
| | | | | | | | |
| | **Deck Buckling "C" Deck** | | | | | | |
| 1 | Replace Deck Plating | | | 850 | 1,000 | 1,850 | |
| | | | | | | | |
| | *TOTAL* | | | | | ***$1,850*** | |
| | | | | | | | |
| | **Breasting Structure** | | | | | | |
| 1 | Sandblast and Re-coat | | | | | 4,425 | |
| | | | | | | | |
| | *TOTAL* | | | | | ***$4,425*** | |
| | **Propeller Box** | | | | | | |
| 1 | Clean and Reweld | | | 2,000 | 21,250 | 23,250 | |
| | | | | | | | |
| | *TOTAL* | | | | | ***$23,250*** | |
| | | | | | | | |
| | **Hull Bilges** | | | | | | |
| 1 | ACM Removal | | | | | 780,000 | |
| 2 | Clean, Sandblast and Paint | | | 20,000 | 1,930,000 | 1,950,000 | |
| | | | | | | | |
| | *TOTAL* | | | | | ***$2,730,000*** | |
| | | | | | | | |
| | **Indoor Swimming Pool** | | | | | | |
| 1 | Pool Structural Analysis | | | | | 225,000 | |
| | | | | | | | |
| | *TOTAL* | | | | | ***$225,000*** | |
| | | | | | | | |

# *HULL and STRUCTURE*

| *No.* | *DESCRIPTION* | *Qty* | *Units* | *Mat'l* | *Labor* | *Total* | *Remarks* |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | **Drydocking** | | | | | | |
| 1 | Remove & Reinstall Dyke | | | | | 2,360,000 | |
| 2 | Drydock,Sandblast, Repair & Paint | | | | | 3,900,000 | |
| | | | | | | | |
| | *TOTAL* | | | | | *$6,260,000* | |
| | | | | | | | |
| | **Hull Exterior Above Waterline** | | | | | | |
| 1 | Staging and Paint | | | | | 650,000 | |
| | | | | | | | |
| | *TOTAL* | | | | | *$650,000* | |
| | | | | | | | |
| | **Watertight Bulkheads** | | | | | | |
| 1 | Repair and Replace | | | | | 629,500 | |
| | | | | | | | |
| | *TOTAL* | | | | | *$629,500* | |
| | | | | | | | |
| | **Exterior Decks** | | | | | | |
| 1 | Repair and Refinish | | | | | 710,000 | |
| | | | | | | | |
| | *TOTAL* | | | | | *$710,000* | |
| | | | | | | | |
| | **Exterior Decks** | | | | | | |
| 1 | Remove and Replace | | | | | 2,950,000 | |
| | | | | | | | |
| | *TOTAL* | | | | | *$2,950,000* | |
| | | | | | | | |
| | **Sports Deck Teak Deck** | | | | | | |
| 1 | New Deck | | | | | 1,200,000 | |

# *HULL and STRUCTURE*

| *No.* | *DESCRIPTION* | *Qty* | *Units* | *Mat'l* | *Labor* | *Total* | *Remarks* |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | *TOTAL* | | | | | ***$1,200,000*** | |
| | | | | | | | |
| | **"R" Deck Repair** | | | | | | |
| 1 | Vinyl Tile and Deck | | | | | 25,000 | |
| | *TOTAL* | | | | | ***$25,000*** | |
| | **Expansion Joints** | | | | | | |
| 1 | Clean, Repair and Paint | | | | | 150,000 | |
| | *TOTAL* | | | | | ***$150,000*** | |
| | **Elevator and Escalators** | | | | | | |
| 1 | Repair and Renew | | | | | 1,925,000 | |
| | *TOTAL* | | | | | ***$1,925,000*** | |
| | **Asbestos Containing Material** | | | | | | |
| 1 | Remove and Clean | | | | | 2,000,000 | |
| | *TOTAL* | | | | | ***$2,000,000*** | |
| | **Handicap Accessibility** | | | | | | |
| 1 | Modifications | | | | | 25,000 | |
| | *TOTAL* | | | | | ***$25,000*** | |
| | **Occupant Egress** | | | | | | |

# *HULL and STRUCTURE*

| *No.* | *DESCRIPTION* | *Qty* | *Units* | *Mat'l* | *Labor* | *Total* | *Remarks* |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| 1 | Signage | | | | | 20,000 | |
| | | | | | | | |
| | *TOTAL* | | | | | ***$20,000*** | |
| | | | | | | | |
| | **Pest Control** | | | | | | |
| 1 | Screens | | | | | 8,500 | |
| | *TOTAL* | | | | | ***$8,500*** | |
| | | | | | | | |
| | **Mooring Lines** | | | | | | |
| 1 | Repair and Replace | | | | | 48,000 | |
| | | | | | | | |
| | *TOTAL* | | | | | ***$48,000*** | |
| | | | | | | | |
| | **Life Boats** | | | | | | |
| 1 | Clean Repair and Paint | | | | | 100,000 | |
| | | | | | | | |
| | *TOTAL* | | | | | ***$100,000*** | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | *TOTAL* | | | | | ***$19,587,620*** | |

# *MACHINERY SUMMARY*

| *No.* | *DESCRIPTION* | *Total* | *Remarks* |
|---|---|---|---|
| | | | |
| 1 | Heating Ventilation and Air Conditioning | 726,200 | |
| | | | |
| 2 | Chilled Water System | 208,000 | |
| | | | |
| 3 | Hot and Cold Water System | 202,000 | |
| | | | |
| 4 | Steam System | 150,000 | |
| | | | |
| 5 | Natural Gas System | 5,000 | |
| | | | |
| 6 | Bilge System | 283,000 | |
| | | | |
| 7 | Ballast System | 82,000 | |
| | | | |
| 8 | Deck Drains | 60,000 | |
| | | | |
| 9 | Sewage System | 223,000 | |
| | | | |
| 10 | Firemain and Sprinkling System | 475,000 | |
| | | | |
| 11 | ReplaceFiremain and Sprinkling System | 1,950,000 | |
| | | | |
| 12 | Firemain Detection System | 300,000 | |
| | | | |
| 13 | Public Address System | 150,000 | |
| | | | |
| 14 | Miccelleneous | 200,000 | |
| | | | |
| | *TOTAL* | *$5,014,200* | |

**Machinery Totals**

# *MACHINERY and PIPING*

| *No.* | *DESCRIPTION* | *Qty* | *Units* | *Mat'l* | *Labor* | *Total* | *Remarks* |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | **Heating Ventilation and Air Conditioning** | | | | | | |
| 1 | Replace Air Handlers | 8 | Each | 180,000 | 50,000 | 230,000 | |
| 2 | Repair and Clean Air Handlers | 18 | Each | 10,800 | 56,000 | 66,800 | |
| 3 | Replace Fan Coil Units | 6 | Each | 18,000 | 10,000 | 28,000 | |
| 4 | Repair and Clean Fan Coil Units | 13 | Each | 3,900 | 6,500 | 10,400 | |
| 5 | Replace Supply Fans | 10 | Each | 25,000 | 8,000 | 33,000 | |
| 6 | Repair and Clean Supply Fans | 50 | Each | 10,000 | 25,000 | 35,000 | |
| 7 | Replace Exhaust Fans | 10 | Each | 20,000 | 8,000 | 28,000 | |
| 8 | Repair and Clean Exhaust Fans | 50 | Each | 10,000 | 25,000 | 35,000 | |
| 9 | Replace Coils | 50 | Each | 50,000 | 20,000 | 70,000 | |
| 10 | Duct Cleaning and Misc Repair | 1 | Each | 25,000 | 75,000 | 100,000 | |
| 11 | Material Handling | 1 | Each | 10,000 | 15,000 | 25,000 | |
| 12 | New Fan Coil Units For Hotel Spaces | 18 | Each | 37,000 | 28,000 | 65,000 | |
| | | | | | | | |
| | *TOTAL* | | | | | *$726,200* | |
| | | | | | | | |
| | **Chilled Water System** | | | | | | |
| 1 | Chilled Water Valves | 200 | Each | 20,000 | 40,000 | 60,000 | |
| 2 | Chilled Water Piping and Fittings | 500 | Feet | 25,000 | 50,000 | 75,000 | |
| 3 | Chilled water Insulation | 500 | Feet | 1,000 | 3,000 | 4,000 | |
| 4 | C/W & Steam for New Fan Coil Units | 18 | Each | 18,000 | 36,000 | 54,000 | |
| 5 | Umbilical | 2 | Each | 5,000 | 10,000 | 15,000 | |
| | | | | | | | |
| | *TOTAL* | | | | | *$208,000* | |
| | | | | | | | |
| | **Hot and Cold Water System** | | | | | | |
| 1 | Valves | 200 | Each | 25,000 | 52,000 | 77,000 | |
| 2 | Piping | 2000 | Feet | 25,000 | 60,000 | 85,000 | |
| 3 | Insulation | 2000 | Lin Ft | 10,000 | 30,000 | 40,000 | |
| | | | | | | | |
| | *TOTAL* | | | | | *$202,000* | |

# *MACHINERY and PIPING*

| *No.* | *DESCRIPTION* | *Qty* | *Units* | *Mat'l* | *Labor* | *Total* | *Remarks* |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | | | | | | | |
| | **Steam System** | | | | | | |
| 1 | Valves | 300 | Each | 20,000 | 40,000 | 60,000 | |
| 2 | Piping | 1000 | Feet | 15,000 | 50,000 | 65,000 | |
| 3 | Insulation | 1000 | Lin Ft | 5,000 | 10,000 | 15,000 | |
| 4 | Umbilical | 2 | Each | 5,000 | 5,000 | 10,000 | |
| | | | | | | | |
| | *TOTAL* | | | | | *$150,000* | |
| | | | | | | | |
| | **Natural Gas System** | | | | | | |
| 1 | Inspect and Repair | 1 | Sys. | 1,000 | 4,000 | 5,000 | |
| | | | | | | | |
| | *TOTAL* | | | | | *$5,000* | |
| | | | | | | | |
| | **Bilge System** | | | | | | |
| 1 | Pumps | 3 | Each | 15,000 | 25,000 | 40,000 | |
| 2 | Piping | - | Each | 70,000 | 100,000 | 170,000 | |
| 3 | Valves | 15 | Each | 30,000 | 43,000 | 73,000 | |
| | | | | | | | |
| | *TOTAL* | | | | | *$283,000* | |
| | | | | | | | |
| | **Ballast System** | | | | | | |
| 1 | Valves | 7 | Each | 21,000 | 30,000 | 51,000 | |
| 2 | Piping | - | Feet | 6,000 | 25,000 | 31,000 | |
| | | | | | | | |
| | *TOTAL* | | | | | *$82,000* | |
| | | | | | | | |
| | **Deck Drains** | | | | | | |
| 1 | Clean | 200 | Each | 5,000 | 30,000 | 35,000 | |
| 2 | Strainer Plates | 200 | Each | 10,000 | 15,000 | 25,000 | |
| | | | | | | | |

# *MACHINERY and PIPING*

| *No.* | *DESCRIPTION* | *Qty* | *Units* | *Mat'l* | *Labor* | *Total* | *Remarks* |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | *TOTAL* | | | | | *$60,000* | |
| | | | | | | | |
| | **Sewage System** | | | | | | |
| 1 | Overhaul Sewage Pumps | 6 | Each | 8,000 | 10,000 | 18,000 | |
| 2 | Valves Overhaul/Replace | 50 | Each | 30,000 | 60,000 | 90,000 | |
| 3 | Piping | 500 | Lin Ft | 35,000 | 80,000 | 115,000 | |
| | | | | | | | |
| | *TOTAL* | | | | | *$223,000* | |
| | | | | | | | |
| | **Firemain and Sprinkling System** | | | | | | |
| 1 | Firemain and Sprinkling | 1 | Sys. | 100,000 | 375,000 | 475,000 | |
| | | | | | | | |
| | *TOTAL* | | | | | *$475,000* | |
| | | | | | | | |
| | **Replace Firemain and Sprinkling System** | | | | | | |
| 1 | Firemain and Sprinkling Replace | 1 | Sys. | 600,000 | 1,350,000 | 1,950,000 | |
| | | | | | | | |
| | *TOTAL* | | | | | *$1,950,000* | |
| | | | | | | | |
| | **Fire Detection System** | | | | | | |
| 1 | Console and detectors | 1 | Sys. | | | 300,000 | |
| | | | | | | | |
| | *TOTAL* | | | | | *$300,000* | |
| | | | | | | | |
| | **Public Address System** | | | | | | |
| 1 | Console and periphails | 1 | Sys. | | | 150,000 | |
| | | | | | | | |
| | *TOTAL* | | | | | *$150,000* | |
| | | | | | | | |
| | **Miscellaneous** | | | | | | |

# *MACHINERY and PIPING*

| *No.* | *DESCRIPTION* | *Qty* | *Units* | *Mat'l* | *Labor* | *Total* | *Remarks* |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| 1 | | 1 | | 75,000 | 125,000 | 200,000 | |
| | | | | | | | |
| | *TOTAL* | | | | | *$200,000* | |

# *ELECTRICAL SUMMARY*

| *No.* | *DESCRIPTION* | *Total* | *Remarks* |
|---|---|---|---|
| | | | |
| 1 | **Substation and Connected Auxiliaries** | 98,825 | |
| | | | |
| 2 | **Second Electrical Room Exits** | 7,575 | |
| | | | |
| 3 | **Emergency Generator Repair and Service** | 15,000 | |
| | | | |
| | | | |
| | *TOTAL* | ***$121,400*** | |
| | | | |
| | | | |
| | | | |
| | | | |

**Electrical Totals**

# *ELECTRICAL*

| *No.* | *DESCRIPTION* | *Qty* | *Units* | *Mat'l* | *Labor* | *Total* | *Remarks* |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | **Substation and Connected Auxiliaries** | | | | | | |
| 1 | Substation No.1 C.B. 600AF | 1 | Each | 2,700 | 225 | 2,925 | |
| 2 | Substation No.1 General | 1 | Each | 150 | 100 | 250 | |
| 3 | Substation No.2 C.B. 800AF | 1 | Each | 2,700 | 225 | 2,925 | |
| 4 | Substation No.2 General | 1 | Each | 150 | 600 | 750 | |
| 5 | Substation No.3 C.B. 1200AF | 1 | Each | 4,500 | 225 | 4,725 | |
| 6 | Substation No.3 General | 1 | Each | 150 | 400 | 550 | |
| 7 | Substation No.4 C.B. 1000AF | 1 | Each | 4,500 | 225 | 4,725 | |
| 8 | Substation No.4 General | 1 | Each | 50 | 100 | 150 | |
| 9 | Substation No.5 C.B. 1200AF | 1 | Each | 4,500 | 225 | 4,725 | |
| 10 | Substation No.5 General | 1 | Each | 2,400 | 3,800 | 6,200 | |
| 11 | Substation No.6 C.B. 1000AF | 1 | Each | 4,500 | 225 | 4,725 | |
| 12 | Substation No.6 General | 1 | Each | 1,400 | 1,700 | 3,100 | |
| 13 | Substation No.7 C.B. 1200AF | 1 | Each | 4,500 | 225 | 4,725 | |
| 14 | Substation No.7 General | 1 | Each | 1,100 | 4,100 | 5,200 | |
| 15 | Substation No.8 C.B. 1600AF | 1 | Each | 4,500 | 225 | 4,725 | |
| 16 | Substation No.8 General | 1 | Each | 600 | 2,400 | 3,000 | |
| 17 | Substation No.9 C.B. 1600AF | 1 | Each | 4,500 | 225 | 4,725 | |
| 18 | Substation No.9 General | 1 | Each | 1,400 | 5,000 | 6,400 | |
| 19 | Substation No.10 C.B. 1000AF | 1 | Each | 4,500 | 225 | 4,725 | |
| 20 | Substation No.10 General | 1 | Each | 500 | 2,200 | 2,700 | |
| 21 | Substation No.11 C.B. 1600AF | 1 | Each | 4,500 | 225 | 4,725 | |
| 22 | Substation No.11 General | 1 | Each | 900 | 800 | 1,700 | |
| 23 | Substation No.12 C.B. 1600AF | 1 | Each | 4,500 | 225 | 4,725 | |
| 24 | Substation No.12 General | 1 | Each | 1,400 | 5,800 | 7,200 | |
| 25 | Substation No.13 C.B. 1600AF | 1 | Each | 4,500 | 225 | 4,725 | |
| 26 | Substation No.13 General | 1 | Each | 800 | 3,000 | 3,800 | |
| | | | | 65,900 | 32,925 | | |
| | *TOTAL* | | | | | *$98,825* | |
| | | | | | | | |

# *ELECTRICAL*

| *No.* | *DESCRIPTION* | *Qty* | *Units* | *Mat'l* | *Labor* | *Total* | *Remarks* |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | **Exits** | | | | | | |
| 1 | Second Electrical Room Exit | 13 | Each | 3,575 | 4,000 | 7,575 | |
| | | | | | | | |
| | *TOTAL* | | | | | *$7,575* | |
| | | | | | | | |
| | | | | | | | |
| | **Emergency Generator** | | | | | | |
| 1 | Service, Check-Out and Repair | 1 | Each | 5,000 | 10,000 | 15,000 | |
| | | | | | | | |
| | *TOTAL* | | | | | *$15,000* | |
| | | | | | | | |
| | | | | | | | |

# *ALTERNATIVE USES STUDY*

| | ALTERNATIVE 1 | | ALTERNATIVE 2 | |
|---|---|---|---|---|
| | | | | |
| OBSERVATION LOUNGE | MUSIC CLUB | 464,500 | COMEDY CLUB | 511,000 |
| QUEEN'S LOUNGE | DINNER THEATER | 482,000 | DINNER THEATER | 482,000 |
| ROYAL SALON | SPORTS BAR | 525,000 | SPORTS BAR | 520,000 |
| WEDDING CHAPEL | MAGIC CLUB | 386,000 | MAGIC CLUB | 381,000 |
| PROM CAFE AND LOUNGE | RESTAURANT | 603,850 | RESTAURANT | 603,850 |
| CHELSEA RESTAURANT | RESTAURANT | 302,000 | RESTAURANT | 300,000 |
| BRITTANIA SALON | COMEDY CLUB | 994,500 | CARD CLUB | 1,090,000 |
| VERANDA GRILL | MUSIC AND DANCE CLUB | 402,500 | MUSIC AND DANCE CLUB | 402,500 |
| SUN DECK MUSEUM | MUSEUM, RENOVATE | 200,000 | MUSEUM, RENOVATE | 200,000 |
| SIR WINSTON ROOM | RESTAURANT | 155,000 | RESTAURANT | 155,000 |
| PROM DK RETAIL SHOPS | RETAIL, RENOVATE | 90,000 | RETAIL, RENOVATE | 90,000 |
| ENLARGE, OPTION | SIR WINSTON ROOM | 150,000 | SIR WINSTON ROOM | 150,000 |
| | | | | |
| | | | | |
| | WITH ENLARGE | **4,755,350** | | **4,885,350** |
| | W/O ENLARGE | **4,605,350** | | **4,735,350** |

# *ELECTRICAL MAINTENANCE*

| *No.* | *DESCRIPTION* | *Qty* | *Mat'l* | *Labor* | *Total* | *Remarks* |
|---|---|---|---|---|---|---|
| | | | | | | |
| | **Maintenance Requirements** | | | | | |
| 1 | C/B Clean, Inspect, Test, and Torque | 13 | 1,450 | 2,925 | 4,375 | |
| 2 | Test Motor Overloads | 20 | 1,850 | 3,000 | 4,850 | |
| 3 | Test GF System | 100 | 7,050 | 15,000 | 22,050 | |
| 4 | Test Insulation (Doble) | 13 | 2,900 | 3,900 | 6,800 | |
| 5 | Test Grounding System | 13 | 2,850 | 5,550 | 8,400 | |
| 6 | Megger Cables | 100 | 3,750 | 7,500 | 11,250 | |
| | | | | | | |
| | *TOTAL* | | | | *$57,725* | |
| | | | | | | |
| | | | | | | |
| | **Emergency Generator Test** | | | | | |
| 1 | Start, Load Test (2Hrs) | 1 | 150 | 300 | 450 | |
| | | | | | | |
| | *TOTAL* | | | | *$450* | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

# Volume III
# APPENDIX "B"

*QUEEN MARY*

**VESSEL ANALYSIS**

**SOURCE**
**AND**
**REFERENCES**

# APPENDIX "B"

The following list represents publications and articles used in the preparation of this report.


ANSI A159.1-1972 Surface preparation specifications
Steel structures painting council

CORPRP Companies, Inc.
Corrosion investigation of the Hotel Queen Mary dated
26 November 1989

NEC - National Electric Code

NFPA - National Fire Protection Association

OSHA - Occupational Safety and Health Administration

Port of Long Beach
Exterior and Interior Hull Investigation Report
dated 16 October 1991

UBC - Unified Building Codes


In addition to the above publications and articles information on specific items were obtained from the following sources:


Entertainment Cost Consultant - David Holtz

ERA - Economics Research Associates

Disney Company

# Volume III
# APPENDIX "C"

*QUEEN MARY*

**VESSEL ANALYSIS**

**DOCUMENT CONTROL**

# APPENDIX "C"

## Document Control

The drawings aboard the vessel totaling a few thousand, include the original builders drawings and subsequent conversion and modification drawings. These drawings are spread throughout the ship with two major areas of storage. The primary storage areas ("A" Deck fwd & "F" Deck aft) are incomplete disarray and each time a drawing is needed, hours or days of searching is required.

The following is offered for the information and consideration of the reader and not listed as a work item or option. But for an item as important as ships drawings, we feel that someone should investigate the possibilities listed below.

To organize the drawings aboard the vessel, one large area should be selected and all drawings delivered to that area, a search throughout the vessel to collect all drawings not delivered to that area

Drawings are to be separated and cataloged using a computer to track each drawing. After all drawings are cataloged and the computer has sorted to some intelligent order, the drawing will be indexed and stored in that sorted order. Drawings not found should be documented.

A single space aboard the vessel should be selected to house the stored drawings with someone in charge of document control. The computer should be used to track the subsequent use of all drawings.

It may be worthwhile having an inexpensive Ozalid blueprinting machine in the area. This would allow someone to take a print of the drawing instead of the original.

The following database fields may represent the minimum information required on each drawing

1. Index No.
2. Drawing No.
3. Drawing Title
4. Original/Print
5. Building/Conversion/Modification
6. Drawing Revision
7. In File/Checked Out
8. Checked Out By:
9. File Location

Search any field to find drawing
Maybe color coded sets for quick ident,
i.e., Blue - builders dwgs
Green - Conversion dwgs
White - Modification dwgs

Amount $ <u>100,000.00</u>

locations and/or the inability to dismantle parts of the ships structures, such as the teak wood decks that cover steel deck plating; interior wood paneling that covers piping and wiring; material, and areas that contain asbestos, tanks that contain ballast, the underwater portion of the hull structure, and the overhead paneling that encloses firemain and sprinkling piping.


This engineering study will determine and evaluate the estimated costs to repair and maintain the structure and facilities and address new concepts developed by ERA.

Using the technical information provided by the inspection engineers, our estimating department has generated a "Projected Cost Estimate" for needed repairs, modifications, and new use concepts. The purpose of this undertaking is to provide the City and the Port of Long Beach, technical and financial information in order to assist in determining recommendations, regarding the present use and future of the Queen Mary. Projected cost estimates are developed for the following items:

**Item I** Analysis of the Physical Condition of the Queen Mary and Minimum Required Investment to Bring the Complex up to Industry Standards.

**Item II** Minimum Required Investment Cost for Maintenance Operations on the Queen Mary.

**Item III** Evaluation of New Use Concepts developed by Economic Research Associates.

The Projected Cost Estimates (PCE) developed from the investigation of the structures and systems, provides information in a range of costs, because of the inexact nature and inability to precisely identify all unknown costs. It is not possible to accurately estimate from available drawings and specifications, the necessary costs involved. The unavailability of equipment manuals, outdated equipment, and systems maintenance information is factored into the range of costs.

Past marine experiences have proven that retrofits (repairs, modifications and conversions) in areas that are not accessible, and for which engineering drawings are not available, provide uncertainties until actual demolition occurs and uncovers unknown conditions that might exist. These unknowns, more times than not, result in a chain reaction affecting areas and systems usually not considered. These costs have also been factored into the range of costs.

The estimated costs to perform the scope of work outlined in the following sections are presented in two categories:

- Immediate Repairs
- Deferred Repairs

*Immediate repairs* represent work that should be performed at the earliest possible date.

*Deferred repairs* identifies work that should be performed within a period of three (3) to five (5) years.

## SUMMARY

From actual investigations, audio gauge readings, reviews of engineering documents, and of various studies and reports, it is our opinion that the basic hull structure, in spite of some deterioration of the hull plating and rivets since its last drydocking, is adequate to allow for continued operation. The life of the hull plating and adjoining structure cannot be

determined until an underwater inspection and testing is performed on the entire 150,000 square feet of underwater surface area, or until the ship is drydocked to clean, inspect and audio gauge the hull bottom plating.

Additionally, machinery components and piping systems along with electrical equipment and wiring systems that require repairs and/or replacement, are opinioned to be adequately suited to allow for continued operation provided maintenance programs are implemented to prevent further deterioration of these systems. Each successive year the structure and/ or systems are operated, gradually contributes to the overall decline. Even though the ship has been well maintained under the operation of Disney, the previous years of operation were highlighted by a poor maintenance program.

The conclusion of the Report, is based upon the scope of work study outlined in the following sections. The following Projected Cost Estimated (PCE) to upgrade the Queen Mary to Industry Standards, where applicable, are provided.

## FACTORS

A Maintenance Program should be implemented as soon as possible. Many of the recommendations listed herein are required to either keep the ship operating or to bring it up to acceptable quality standards. Following completion of these items, a Preventive Maintenance Program is necessary to keep the Floating Structure from considerable deterioration for an extended period of time.

Because of the volume of work required at so many locations throughout the ship, it is also our opinion that it would be necessary to accomplish that work in a minimum of a Three Year Planned Program. This would reduce the impacts on operations, improve efficiencies in Re-Construction and Management and allow for a more controlled cash flow.

Rados has attempted to provide an accurate statement of the vessels conditions, and accurate "Projected Cost Estimates" (PCE). The enclosed various cost projections are considered budgetary in nature. In some cases, where access to particular structures or systems was limited, educated guesses are provided based upon past experiences in the marine industry. All information and costs provided are predicated upon normal working hours and days. The information contained in this report is believed to be reasonably correct, but not guaranteed, and Rados International Corporation shall not be responsible for any errors, omissions or misrepresentations.

Due to the configuration of the ship, normal techniques of commercial building construction

do not apply. Conversion contractors working in a shipboard environment are usually limited to personnel experienced in the marine industry rather than those in building trades. These maritime shipwrights are accustomed to working in a compartment which is curved in almost every direction, while at the same time, floating and rolling from side-to-side. The normal building construction techniques which utilize plum bobs and carpenter levels, are not acceptable for most of these applications because of the curvature of the decks from shear and camber. This labor factor has been included in the costs to upgrade and maintain the ship.

A particular area of concern is developing costs related to this study, involve the inclusion of material handling costs for repairs, maintenance and remodeling. For any "area" aboard the ship, the transport of materials from the shore to specific locations within the ship, cause significant cost impacts not normally encountered. This logistics problem for the handling of large and heavy materials from shore to ship is difficult because of the necessity of heavy lift crane requirements and the necessity of multiple movements for each item to arrive at its final destination. The difficulties and cost impacts increase significantly as the materials are distributed and transferred throughout various compartments within the ship. Depending upon the location of the work-area, access for large steel plates, structural components, over sized equipment, panelling, carpet and like items is severely limited. Even though some trunk access is available, rail systems and rigging systems need to be installed in each space to transport oversized and heavy objects. The forward trunk space on decks "A", "B" and "R", were decked over during the conversion to create continuous decks and utilize the spaces more effectively. This covering negated the possibility of utilizing this trunk for material distribution. The uptakes in the boiler rooms, the areas from which all machinery and material was removed during the conversion, were recovered and the funnels replaced atop, thereby eliminating the trunks as viable material handling accesses. The aft trunk although more accessible, is limited to specific areas in the stern. Access for material handling through the convention area via double ramp doors is the most direct access for spaces within the convention areas and boiler rooms. Door access into each compartment limits the sizes of materials which can enter a space unless larger openings are created to transit throughout spaces within the ship. Replacing these cut-out openings additionally add to the cost factor of the material-handling phase.

In summary, considerable time and effort has been expended investigating systems aboard the ship, reviewing engineering documents and examining previous studies and reports of the various structures and systems aboard the Queen Mary. The following "Summary Sheet" represents the Projected Cost Estimates as determined for the minimum investment required to:

a). Bring the complex up to industry standards.
b). Provide for a comprehensive maintenance operation.
c). Incorporate new use concepts as developed by ERA.

# HOTEL QUEEN MARY
# VESSEL ANALYSIS

## RADOS INTERNATIONAL CORPORATION
## P.C.E. ESTIMATE

## SUMMARY SHEET

| CATEGORY | DESCRIPTION | TOTAL |
|---|---|---|
| A) | Analysis of the Physical Condition of the Queen Mary and Minimum Required Investment to Bring the Complex Up To Industry Standards | |
| | • Immediate Items | $ 5,987,045.00 |
| | • Deferred Items | $ 21,119,175.00 |
| | TOTAL | $ 27,106,220.00 |
| B) | Minimum Required Investment Cost for Maintenance Operations on the Queen Mary. | $ 4,853,333.00 |
| C) | Evaluation of New Use Concepts as Developed by ERA. | |
| (1) | Nitetime Entertainment Center | $ 4,809,550.00 |
| (2) | Card Parlor Combined With Entertainment Center | $ 4,939,550.00 |
| (3) | Maritime Museum on Shore with Mini-Tour | $ 50,000.00 |

# Volume III
# SECTION II

## *QUEEN MARY*

## VESSEL ANALYSIS

## INTRODUCTION
## TO
## RADOS INTERNATIONAL CORPORATION

# RADOS INTERNATIONAL CORPORATION

Rados International Corporation is a privately held California corporation located in its office building at 1300 South Beacon Street in San Pedro, California overlooking the Los Angeles Harbor.

The corporation, a naval architectural and marine engineering firm is the current organization under the Rados family ownership and management now in its third generation, which has been continually devoted to serving the needs of the marine industry and those of the U.S. and foreign governments. The staff and management of Rados International is dedicated to maintaining the high degree of professional excellence in all operational areas. This standard has become recognized throughout the industry as the hallmark of engineering, design and program management undertaken by Rados International.

The corporation has provided the following activities for both the domestic and international clients:

- Ship and marine structure design and engineering
- Ship and modification design and engineering
- Special ships system design and engineering
- Shipbuilding facilities design and engineering
- Ship Brokerage
- Marine Surveyor services
- Owners resident inspection services
- Scientific and computer analysis of marine structures
- Conceptual studies
- Concept study development
- Technical training in ship and shipboard systems
- Technical consulting service

Our staff of Naval Architects, marine engineers and other professional personnel are thoroughly conversant with the current rules and regulations of American Bureau of Shipping (ABS), Bureau Veritas, Germanischer Lloyds, Det Norske Veritas, U.S. Maritime Administration (MARAD), and Lloyd's Register. We are thoroughly acquainted with U.S. Coast Guard (USCG) regulations, Safety of Life at Sea (SOLAS), and Inter-Governmental Maritime Consulting Organization (IMCO) requirements as they apply to new designs and modifications to existing vessels.

During the past years the Rados Group designed and constructed a number of vessels for the Department of the Navy, Army and Air Force as well as for the commercial industry. Major repairs and modifications were performed on all types of naval and commercial vessels.

Typical programs performed by Rados International Corporation include design engineering and construction supervision for both military and commercial industries including tankers, cargo vessels, oil drilling vessels, ocean mining vessels, pipe laying barges, cable laying vessels, oceanographic vessels, fishing vessels, passenger vessels and fire fighting boats.

Major modification projects include work on aircraft carriers, battleships, cruisers, frigates, destroyers, the HMS Queen Mary, the HMS Queen Elizabeth, the S.S. United States, Princess Cruise Lines, Cunard Cruise Lines, Admiralty Cruise Lines and Automation of Engine Rooms on various ships.

Our services have been performed in over ten different countries of the world.

During the past years, the Rados Corporations have received letters of commendation and awards from the United States Department of the Navy, Branches of the Army and Air Force; Governments of Argentina, Mexico, England, Spain and Italy, and from domestic and foreign shipping corporations for efficiency in design, construction and cost containments.

In 1967, Rados International Corporation was selected over a number of firms in the United States to provide a team of engineers to board the HMS Queen Mary in Southampton, England and travel with the vessel to New York and back to investigate and determine the condition of the vessel, its machinery and equipment. Report of findings were submitted to the City of Long Beach. Rados was subsequently selected as the Naval Architecture and Marine Engineering firm to design and develop detail construction drawings and specifications to convert the HMS Queen Mary a floating structure, into a hotel, convention center, museum, shopping area, restaurants and tour facility.

During the past years, Rados International Corporation has been awarded contracts by the Wrather Corporation and later the Disney Company to perform studies and develop detail construction drawings and provide supervision for repairs, maintenance and modifications to the structure and for new attractions aboard the Queen Mary.

Over the past 25 years, Rados International Corporation has developed its library and files of various specifications, drawings and equipment lists of both the originally designed vessel, modification drawings of her conversion in 1968-71, and subsequent space and equipment modifications undertaken.

# Volume III
# SECTION III

## QUEEN MARY

## VESSEL ANALYSIS

## A HISTORY OF THE QUEEN MARY

# HISTORY OF THE QUEEN MARY PROGRAM

The Queen Mary was designed and constructed by the John Brown Shipyard, Clydebank, Scotland in the year 1936. The original main characteristics of the ship were as follows:

| | | |
|---|---|---|
| Overall Length | 1019.6 | Feet |
| Beam | 118.0 | Feet |
| Draft | 39.4 | Feet |
| Gross Tonnage | 81,23.7 | Tons |

The hull was designed and built in accordance with the Rules and Regulations of British Lloyds (Lloyds of London) for the highest class 100 A1. Future modifications to structural elements of the floating structure have generally conformed to the Uniform Building Code (UBC). Where ship structures are involved the elements have conformed to the Principals of Naval Architecture and Marine Engineering.

The hull structural elements (plates, shapes and rivets) were constructed using mild steel No. 28-32. This material is roughly equivalent to A-36 structural steel with a yield strength of 33 KSI (Kips per square inch). 1 Kip = 0.45 L.T.

The hull plate thickness as designed, ranges from 1.05 inches on the bottom plating, to 1.20 inches on the turn of the bilge, to 1.01 inches at the "A" Deck which forms the strength deck of the Queen Mary. The bow and stern hull plating areas vary from .72 inches to .80 inches in thickness, due to the less bending moment (stress) requirements for the hull structure. These plate thicknesses far exceed the requirements set forth by the strict Lloyd's Register of Shipping Classification Society.

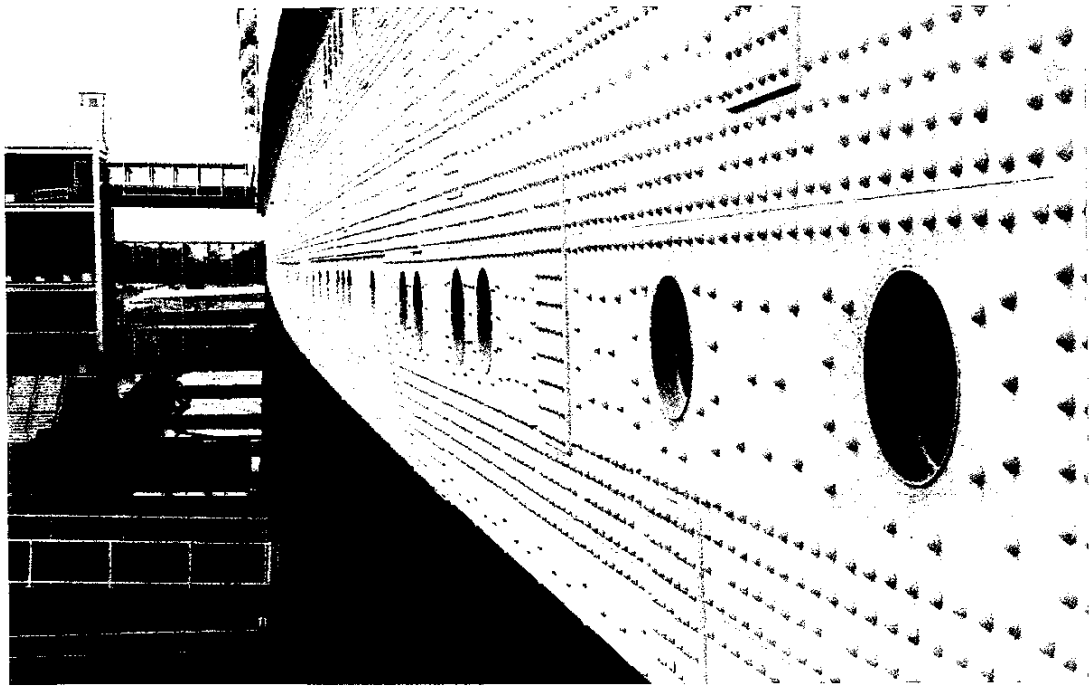
The steel frame-spacing within the ship varies from 24 inches at the bow and stern areas, to 36 inch spacing at the mid-section area of the vessel. These frames running athwartship (Port to Starboard) are .50 inches thick and have lighting holes cut out of the frames to reduce weight.

The Queen Mary was designed with thirteen (13) decks. The strength deck, namely the "A" Deck is .66 inches thick, while the other decks are .50 inches in thickness.

The hull area below the "R" Deck was subdivided into seventeen (17) watertight bulkheads with access through remote controlled watertight doors. These bulkheads and doors were constructed using .50 inch plate.

As the vessel exists today, only two originally constructed watertight bulkheads remain as initially constructed. The remaining fifteen (15) W.T. Bulkheads have been extensively modified or have had major portions of the bulkheads removed. Additionally, none of the remote controlled watertight doors initially installed in the bulkheads are operable. Most have been locked in the open position with pneumatic piping disconnected.

The hull structure of the vessel was constructed using ten million steel rivets to fasten the steel plates to the scantlings. These rivets were 1-1/8 inch in diameter and varying from 2 to 6 inches in length. The hull structure in terms of strength, far exceeds current construction methods, and is considered one of the strongest commercial passenger liners ever built.



**HULL PLATING AND RIVETING PORT SIDE**

During the construction of the Queen Mary, asbestos containing materials (ACM) were used in practically every form of marine construction providing thermal protection, insulation and fire protection to piping, interior bulkheads and compartmentation boundaries. A typical product used aboard the ship was "Turnall Asbestos Wood". This material will not burn and resists fire. This material was used in the construction of staterooms, hallways, lounges, dinning rooms, restaurants, offices, etc. ACM was used for pipe insulation as well as ducting for air and heating, and it was used as insulation and sound proofing for machinery equipment, boiler rooms, electrical wiring systems, and the like.

The ship contains 13 elevators, which were installed in 1934 to move passengers from deck to deck. These elevators were not fully automatic and do not meet state and federal requirements.

The HMS Queen Mary contained 321 first class staterooms, 347 cabin class rooms and 281 tourist class cabins, for a total of 949 staterooms for the passengers located on Main; "A" and "B" Decks. There were also staterooms for 1174 officers and crew.

**TYPICAL STATEROOM**

The ship contained three (3) separate zones for the passengers, the bow section contained the tourist class, the midship section contained the first class, and the aft section contained the cabin class. Each zone had their own cabins, dining facilities, restaurants, galleys, lounges and entertainment areas.

The HMS Queen Mary contained 27 boilers and four turbine engines producing 200,000 horsepower, thus producing a speed of 31.69 knots (37 mph).

The ship contained (24) lifeboats, each carrying 124 people. The boats contained diesel engines and supplies. The Queen Mary's illustrious career included 2,114,000 paying passengers and a total traveled distance of 3,807,277 nautical miles. she saw service as a troop carrier, hospital, and British command ship.

# Volume III
# SECTION IV

*QUEEN MARY*

## VESSEL ANALYSIS

**AN INVESTIGATION OF**
**THE QUEEN MARY**
**PERFORMED SEPTEMBER 26, 1990**
(REQUESTED BY PORT OF LONG BEACH)

# QUEEN MARY
# VESSEL ANALYSIS

## INVESTIGATION OF THE QUEEN MARY STRUCTURAL ANALYSIS STUDY

Sometime after the conversion of the Queen Mary, which occurred during the period of 1968-71, several conditions concerning buckling of the decks appeared. After a thorough investigation and analysis of the complete structure it was determined that the primary reason for these distortions, was the removal of internal bulkheads and trunks to allow access for rip-out and removal of the ships boilers and equipment and re-installation of replacement materials and equipment. These removed structures were never reinstalled by the contractor due to proposed future developments of the lower areas. Other remaining structural members were modified to enlarge interior areas and only local strength members were replaced.

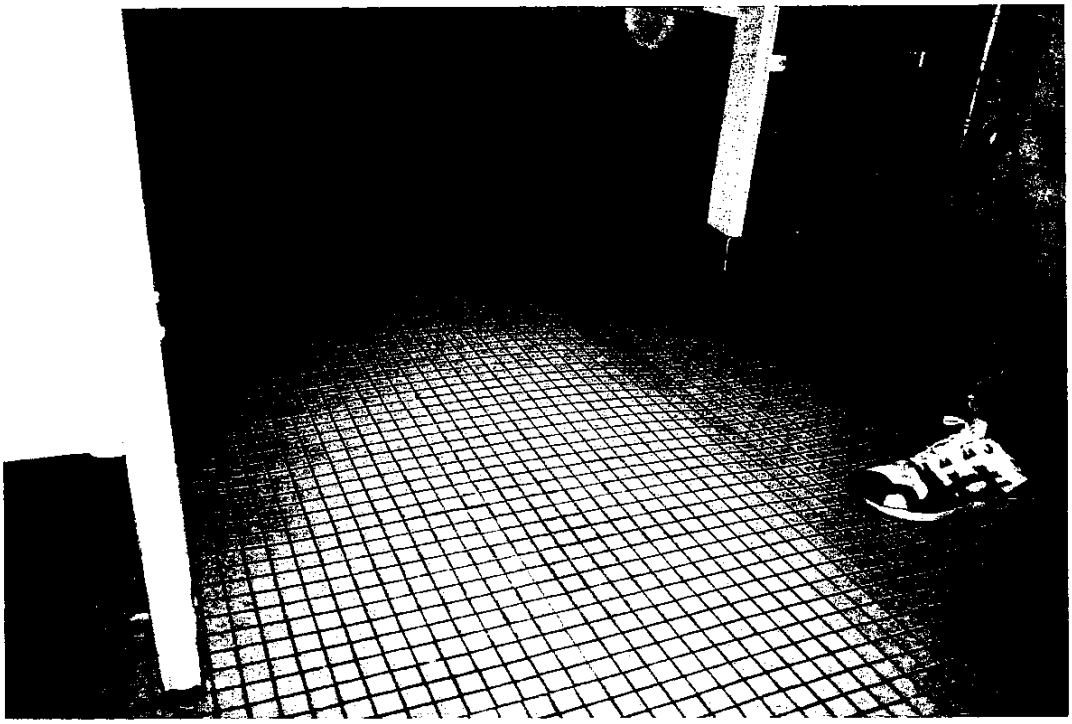
### I. DECK BUCKLING

#### 1. "A" Deck Frames 255 - 258 - "Restroom"

"A" deck, frames 255 - 258, show evidence of overstress in the form of deck buckling and distortion in an area 3 feet x 5 feet on the port side of the vessel.

The buckling appears near the middle of a structural deck area (panel) between frames 255 and 261 and from the ships centerline to the inboard longitudinal system at 14'-6" starboard. Originally, this panel had support assistance from bulkheads over and under at 10'-0" off centerline. These bulkheads were removed. As a consequence, the panel size was doubled by removal of the centerline structural bulkhead. (Note: Some wooden joiner bulkheads were put back in, but provide no structural support).

The buckled "A" deck at frames 255 - 258 is located in a public restroom. Recommended repairs would be the installation of a 3", schedule 40 pipe stanchion between "A" deck and "B" deck at frame 257. Retile floor area as necessary.



"A" DECK RESTROOM - FR. 255 - 258

This would not impair the use of the lock shop existing on "B" deck below. A bulkhead below "B" Deck would carry out this loading.

Amount **$ 2,095.00**

2. "B" Deck Frames 177 - 180 — "Fan Room"

"B" deck, frame 178, shows evidence of overstress in the form of deck buckling and distortion in an area about 5 feet x 5 feet in the Fan Room near centerline. This area is occupied by ship's service personnel.

This 15 foot section of decking on "B" deck separates two (2) large openings, namely the uptake truck No. 2 and the open area providing the high overhead for the Main Convention Hall. This deck was originally supported by the uptake trunk bulkheads. With the removal of the trunk, stanchions were installed to carry vertical loads, but they give little support for horizontal loads, either fore-and-aft or transverse. The horizontal loads would come from twisting motions on the ship's fendering system and some combined loads due to hogging of the vessel. Whereas sagging is the drooping of the midship portion relative to the bow and stern, hogging is the straining of the ship which makes the bow and stern lower than the midship section.

Since any stiffening or cross bracing in the middle of the Windsor room would be unacceptable, it is recommended to just keep a periodic review of the deck area. It is anticipated that the buckling and distortion will not continue, as long as no additional loads or excess hogging conditions occur, and if the present fendering system is modified to incorporate rubber fenders. We Recommend that the areas be paved over the height of the ripples on "B" deck to eliminate possible tripping hazards.

Amount **$ None**

3. <u>"C" Deck Frame 191 — "Passageway"</u>

An investigation of "C" deck, at frame 191, approximately 28 feet, port side, shows evidence of overstress in the form of deck buckling and distortion. This area is approximately 2 feet x 3 feet and is located in a passageway used by the ship's tour.

The "C" deck was originally designed near the neutral-axis of the hull girder, and therefore, did not receive much stress loading from hogging and sagging of the hull. During the conversion, the "R" deck was decked-in completely and became the new "upper flange" of the hull girder.

With much of the uptake trunk structure removed, it effectively formed an expansion joint down to the "R" deck to work with the existing expansion joint at frame 180-1/2, thus relieving the Main deck as the upper flange.

Cutting away of large arches through the main longitudinal bulkheads, 14'-6" port and starboard at frames 190 - 192, has occurred for tour viewing of the Boiler Room spaces. Even though stanchions were installed to carry vertical loads, they are not effective when resisting the new hogging, torsional loads and fender loads. Recommend removing section of deck and replace with new plating.

Amount **$ <u>1,850.00</u>**

4. "D" Deck Frame 111 - "Convention/Exhibit Area"

"D" deck at frame 111 revealed that the only buckling and torsion that occurred was due to the underlayment of cement. The underside of the decking appeared to be free from undue stress and buckling. With the modification to the fendering system there should be no concern regarding deformation of "D" deck and its related structure. Repairs have been made by the ship's maintenance crew.

## II. PIPING SYSTEMS - BILGE TRANSFER SYSTEM

The bilge transfer costs are included in Section 7, Mechanical and Piping System Report

# HOTEL QUEEN MARY
# VESSEL ANALYSIS

## HULL STRUCTURE ANALYSIS

## SUMMARY SHEET

| No. Description | Qty. | Mat'l. | Labor | Immed | Defer | Total |
|---|---|---|---|---|---|---|
| I. DECK BUCKLING: | | | | | | |
| 1 "A" Deck - Restroom | 1 | 295.00 | 1800.00 | 2095.00 | ------- | 2095.00 |
| 2 "B" Deck - Fan Room | 1 | ---- | ------ | ------- | ------- | None |
| 3 "C" Deck - Passageway | 1 | 250.00 | 1600.00 | ------- | 1850.00 | 1850.00 |
| 4 "D" Deck - Restroom | 1 | ------- | ------- | ------- | ------- | None |
| II. PIPING SYSTEMS: | | | | | | |
| See Section VII - Item 7 | | | | | | |
| | | TOTAL | | **2095.00** | **1850.00** | **3945.00** |

# Volume III
# SECTION V

## *QUEEN MARY*

## VESSEL ANALYSIS

## AN INVESTIGATION OF THE QUEEN MARY EXTERIOR AND INTERIOR HULL PLATING STUDY PERFORMED DECEMBER 1990

(REQUESTED BY PORT OF LONG BEACH)

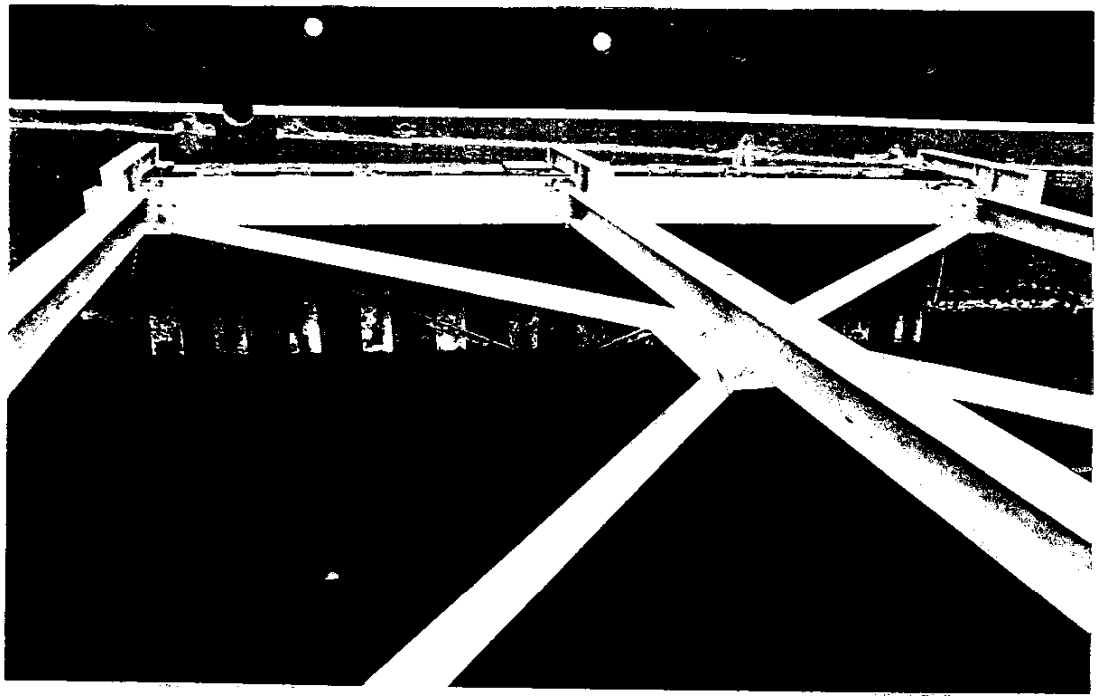
# QUEEN MARY
# VESSEL ANALYSIS

## AN INVESTIGATION OF THE EXTERIOR AND INTERIOR HULL STUDY PERFORMED DECEMBER 1990

A survey was performed for the Port of Long Beach to investigate the condition of the Queen Mary, primarily in the areas of the breasting structure, propeller box, bilges and swimming pool. The following report and findings are submitted.

### 1. BREASTING STRUCTURE:

Inspections revealed that the coating has deteriorated and disbanded and is not effectively coating the structure in the splash zone. To inhibit corrosion of the wetted surface of the structure at the waterline at various tide levels, requires corrective welding and reapplication of the corrosion resistant coating. Cathodic protection is not effective in areas such as the splash zone which are not completely submerged.



**BREASTING STRUCTURE**

The Breasting Structures should be sandblasted and re-coated to inhibit future corrosion.

Amount $ **4,425.00**

## 2. PROPELLER BOX:

The propeller box has been cleaned and repaired by the Disney Company and an automatically controlled impressed current rectifier, (Cathodic Protection System) has been installed to eliminate future corrosion to the steel box structure. Chemicals are routinely added to the fresh water in the structure to minimize imbalances and abate corrosion.

Interior and exterior sections of the propeller box welding seams, are deteriorated and will require future rewelding. This will require the services of an underwater diver to clean the exterior areas and reweld. Interior areas will require the removal of water from the box, erection of staging and welding of seams.

Amount $ **23,250.00**

**PROPELLER BOX**

## 3.-23. HULL BILGES - FRAMES 300-51 (item 13 excluded):

The Bilge and Interior Bilge areas of the Boiler Room, Generator, Engine Room Shaft Alley, Refrigeration Room and Aft Steering Compartment were inspected in those areas that were accessible and free of Asbestos Containing Material (ACM).

The Boiler Room, Generator and forward Engine room frames 112 to 289 are contaminated with ACM and therefore, unavailable for close inspection and Audio Gauging of tank tops to determine plate thickness. During the past number of years contaminated water, trash, debris, and dissimilar metals, have laid in the bilge area causing considerable corrosive action to the tank tops and structures.

**BOILER ROOM No. 3**
**AND DOUBLE BOTTOM TANK TOPS**

The contaminated water has been removed from the boiler room bilge area and visual inspections indicate considerable corrosion has occurred to tank tops and structures.

FWD TURBO GENERATOR ROOM - BILGE

BOILER FOUNDATION
AND
ACCESS TO DOUBLE BOTTOM TANKS

Due also to the continuous falling of ACM fibers from the overhead panels, the area is restricted for performing further studies and reports.

An immediate concern should be to remove the Asbestos Containing Materials, and sandblast and paint to further reduce deterioration of the plates and structure. As shown in the photographs, there is no watertight integrity within the respective compartments because of the removal of portions of the watertight bulkheads. Should the vessel for some reason incur a serious, fast flowing leak, damage control in limiting the compartments to be flooded would be non-existent. A serious, un-manageable leak would most likely cause the structure to sink.

The aft section of the Bilge, until recently, had also been filled with contaminated water, debris, trash and dissimilar metals which has caused extensive corrosion to the hull plating, rivets and structures. The majority of contaminated ballast water in the double bottom tanks, has been removed and drilling mud has been inserted as ballast in the double bottom tanks. Trash, debris and dissimilar metals are still present in the bilge aft, thus, a corrosive action and further deterioration of plating, rivets and structure still exists.

**BILGE DETERIORATION**
**CENTERLINE / AFT**

This area also contains loose ACM.

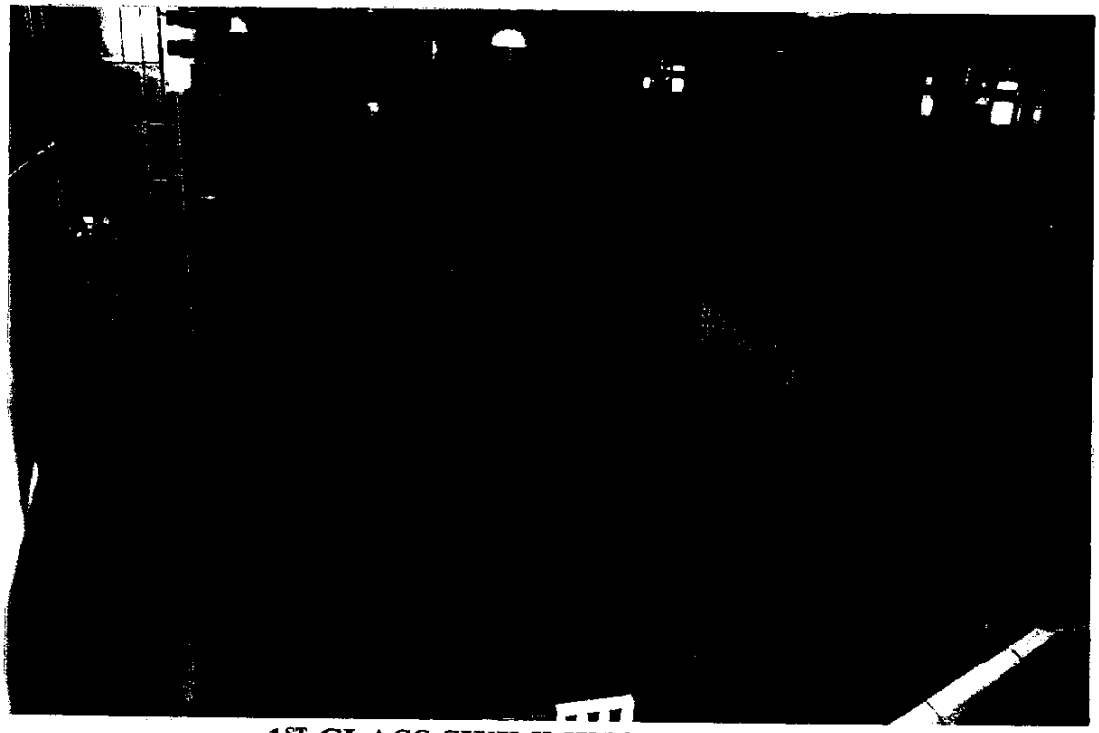
Removal of ACM and trash from the after section of the vessel should also be initiated. Until this area is cleaned and sandblasted, readings cannot be taken in the critical areas. The areas above the contaminated bilges indicate a corrosion loss of approximately 15 %.

| | |
|---|---|
| ACM Removal | $ 780,000.00 |
| Clean, Sandblast & Paint | $ 1,950,000.00 |
| TOTAL | **$ 2,730,000.00** |

## 13. INDOOR SWIMMING POOL:

The Pool is of rectangular shape, 35 feet long and 22 feet wide. The depth varies from 7 feet to 8 feet, 6 inches. The capacity of salt water used in the pool is about 29,000 gallons with a weight of approximately 109 long tons.

The pool is located between "C" and "D" Deck between frames 212 to 222 at the centerline of the structure. The top of the pool and exposed structures on or above are covered with decorated tiles about one inch thick. Severe cracking and deformation of the tiles and concrete underlayment occur when the pool is filled with water.



1ST CLASS SWIMMING POOL

Investigations of the Pool Complex revealed that due to the number of years of continuously using salt water in the pool combined with the heat generated by operation of the generators below, and the moisture trapped in the enclosed structure beneath the pool, the steel lining and structural members of the cofferdam of the pool have severely deteriorated. Should the pool be considered operational at some future time, expensive repairs would be required. Additionally several supporting structures on the port side of the pool structure were removed during the conversion to accommodate the application of cement on the floor of "D" deck. This removed structural support, adds significantly to the movement of the pool and has created the cracks to the pool cement and tile. This movement appears to be most prevalent when the pool is filled.

**STRUCTURAL FOUNDATION UNDER 1ST CLASS POOL**

A structural analysis of this area is required to establish the requirements for installation of transverse bulkhead structures deemed necessary.

The Ultrasonic Thickness Measurements for the Swimming Pool Area are:

| | Area Thickness | | |
|---|---|---|---|
| Location | Max | Min | Average |
| Port Side | 0.440 | 0.070 | 0.317 |
| Bow Side | 0.450 | 0.375 | 0.380 |
| Starboard Side | 0.370 | 0.055 | 0.178 |
| Lower Plate | 0.475 | 0.050 | 0.366 |

The minimum thickness readings are from isolated locations, around the pool structure.

Amount **$ 225,000.00**

# QUEEN MARY
# VESSEL ANALYSIS

## HULL STRUCTURE ANALYSIS

## SUMMARY SHEET

| No. | Description | Qty | Mat'l | Labor | Immed | Defer | Total |
|---|---|---|---|---|---|---|---|
| 1. | Breasting structure | 2 | 1,500.00 | 2,925.00 | 4,425.00 | ------ | 4,425.00 |
| 2. | Propeller Box | 1 | 4,500.00 | 18,750.00 | ------ | 23,250.00 | 23,250.00 |
| 3. | Internal bilges Frame 300-51 | 1 | 630,000.00 | 2,100,000.00 | 2,730,000.00 | ------ | 2,730,000.00 |
| 4. | Swimming pool | 1 | 65,000.00 | 200,000.00 | ------ | 265,000.00 | 265,000.00 |
| | | | | **TOTAL** | **2,734,425.00** | **288,250.00** | **3,022,675.00** |

# Volume III
# SECTION VI

*QUEEN MARY*

## VESSEL ANALYSIS

## CURRENT
## HULL ANALYSIS
## AND
## REPORT OF FINDINGS

# QUEEN MARY
# VESSEL ANALYSIS

## CURRENT
## HULL ANALYSIS
## AND
## REPORT OF FINDINGS

The Hull Structure of the Queen Mary was investigated for purposes of determining the Projected Cost Estimated (PCE) to bring the hull structure up to industry standards. No shore facilities or functions were studied with the exception of mooring lines, gangways and breasting structures.

The hull characteristics of the Hotel Queen Mary since the conversion during the period of 1968-1971 are as follows:

| | | |
|---|---|---|
| Draft | 34.5 | Feet |
| Ship Weight | 44,225 | Long Tons |
| Liquid and Ballast | 22,501 | Long Tons |
| Total Displacement | 66,726 | Long Tons |

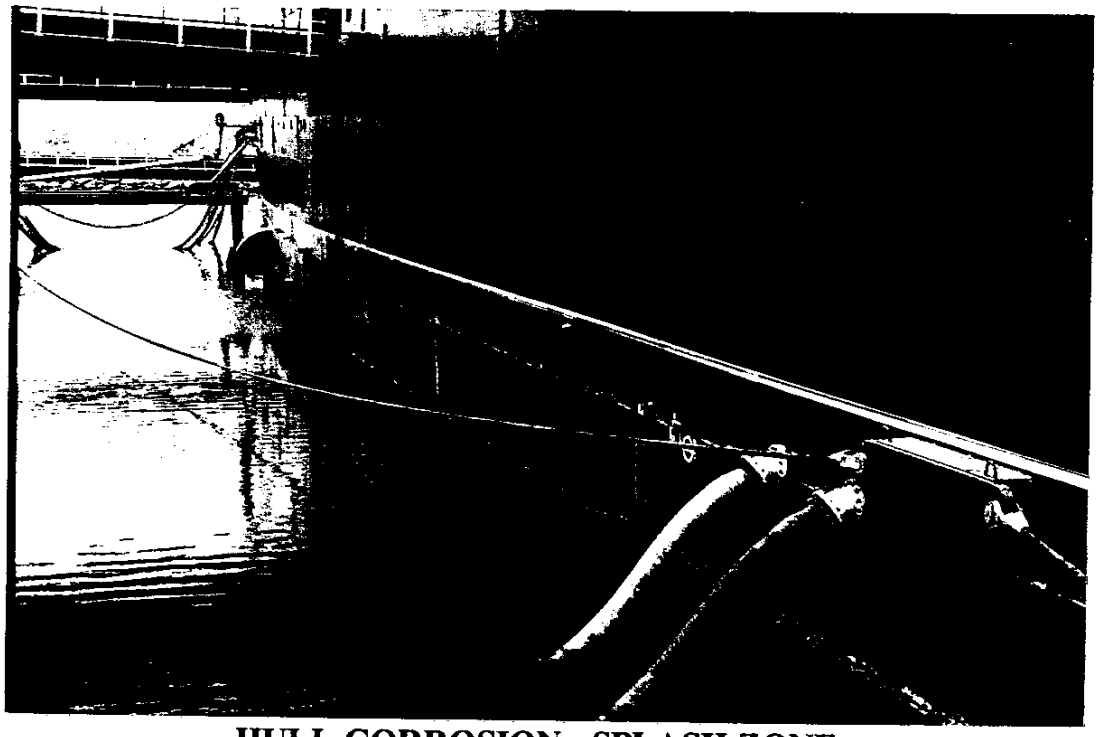
The exterior underwater hull plating (150,000 square feet) and rivets were not inspected by underwater divers due to time restraints and cost restriction.

## HULL STRUCTURE

### 1. A. Hull Exterior - Below Waterline (Drydocking)

During the conversion period of the Queen Mary, Rados developed a "Hull Corrosion Study" for the Long Beach Queen Mary Department for purposes of determining theoretically the projected amount of plate wastage (deterioration) that would occur during the life of the vessel. The conclusion of the study revealed that within a period of twenty-five (25) years the Queen should be re-drydocked to inspect and repair deteriorated plating, rivets, and plate inserts that have covered the one-hundred (100) sea chest openings. The hull structure should be cleaned, sandblasted, and painted within the next 3 to 5 years.

This "Corrosion Study" took into consideration the cathodic protection system (impressed current) presently existing aboard the Queen Mary which consists essentially of ten (10) rectifiers of which five (5) rectifiers are utilized for protection of ships hull.



**HULL CORROSION - SPLASH ZONE**

In order to drydock the Queen Mary, a portion of the rock dike has to be removed and then again reinstalled along with gangways, connections and mooring lines, etc.

| | |
|---|---|
| Remove and Reinstall Rock Dike, Gangways, etc. | $ 2,360,000.00 |
| Drydock & Sandblast, Repairs & Paint | $ 3,900,000.00 |
| Amount | **$ 6,200,000.00** |

**B. Hull Exterior - Above Waterline**

The exterior are of the Queen Mary will require painting within a period of 1 to 2 years in order to control the rust and deterioration of structure. Staging will be required to paint sides, superstructure, funnels and mast.

Amount **$ 650,000.00**

C. Hull Interior - Bilge Area

After asbestos containing material is removed from tank tops and bilge areas, cut and remove rusted and deteriorated former boiler foundations. Sandblast and clean area and repair as necessary. Paint total area of bilge up to "D"-Deck and up to "F"-Deck where shell is enclosed. Painting is to include framing, bulkheads, tank facing and interconnected steel work including underside of decks.

Amount $ See Section V Item 3

## 2. WATERTIGHT BULKHEADS:

The Queen Mary was designed and constructed with eighteen (18) watertight bulkheads from the double bottom tanks (tank top) to the "F"-Deck forward (approximately 35 feet high) and "G-Deck Aft (approximately 20 feet high). These structural bulkheads were constructed from .50 inch plate with seven (7) 4'-6" x 18-1/2" I-beams and thirty-five (35) 10" x 7" x 1/2" I-beams spaced in between for stiffeners per bulkhead.

Due to the removal of boilers, generators and machinery during the 1968-71 conversion period, the majority of bulkheads were partially removed to allow space for removal and re-installation of materials and equipment. They were not replaced for structural strength or watertight integrity for reasons of future development of those areas. Presently there exists extensive corrosion to the bulkheads where they come into contact with the contaminated bilges.

As previously mentioned, the Queen Mary has no watertight integrity as required by regulatory bodies for a floating structure. If a certain hull plate or plates became defective and water leaked into the structure it could not be contained due to the present status of the non-watertight bulkheads and therefore the water would flood the whole structure and very probably sink. This major concern is perhaps the most serious condition aboard the ship from a naval architecture point of view.

Presently, the majority of the tank top areas are covered with Asbestos Containing Material (ACM). This is due to the ACM panels that were installed in the uptakes (stack area) to provide for heat retention within the machinery spaces and avoid penetration into the staterooms and other areas. This hazardous material would be required to be removed by a qualified firm prior to any work is preformed in these areas.

**ACM PANELS - UPTAKE**

To repair and replace watertight bulkheads only small sections of steel can be used due to limited openings in the hull structure. Extensive amounts of staging would be required to handle and erect the following watertight bulkheads.

Watertight bulkhead 21 is forward of the propeller shaft tunnel. This area appears to have heavy corrosion due to contaminated water, trash and dissimilar metals laying in bilge area. This bulkhead is penetrated by pipes and ducts. The penetration should be blanked-off and four (4) watertight doors installed for watertight integrity.

Watertight bulkhead 87 has a large opening that requires plate replacement and stiffeners. Miscellaneous penetrations are to be blanked-off and two (2) watertight doors installed.

Watertight bulkhead 112 is partially watertight up to the twelve (12) foot flat. Steel plate and stiffeners are to be installed up to the "F"-Deck for watertight integrity. Penetrations to be blanked-off and two (2) watertight doors installed.

Watertight bulkhead 168 has four (4) large open areas at the 11-foot flat that requires re-plating and installation of stiffeners. Piping runs and ventilation duct openings require closures to make watertight. Install one (1) watertight door.

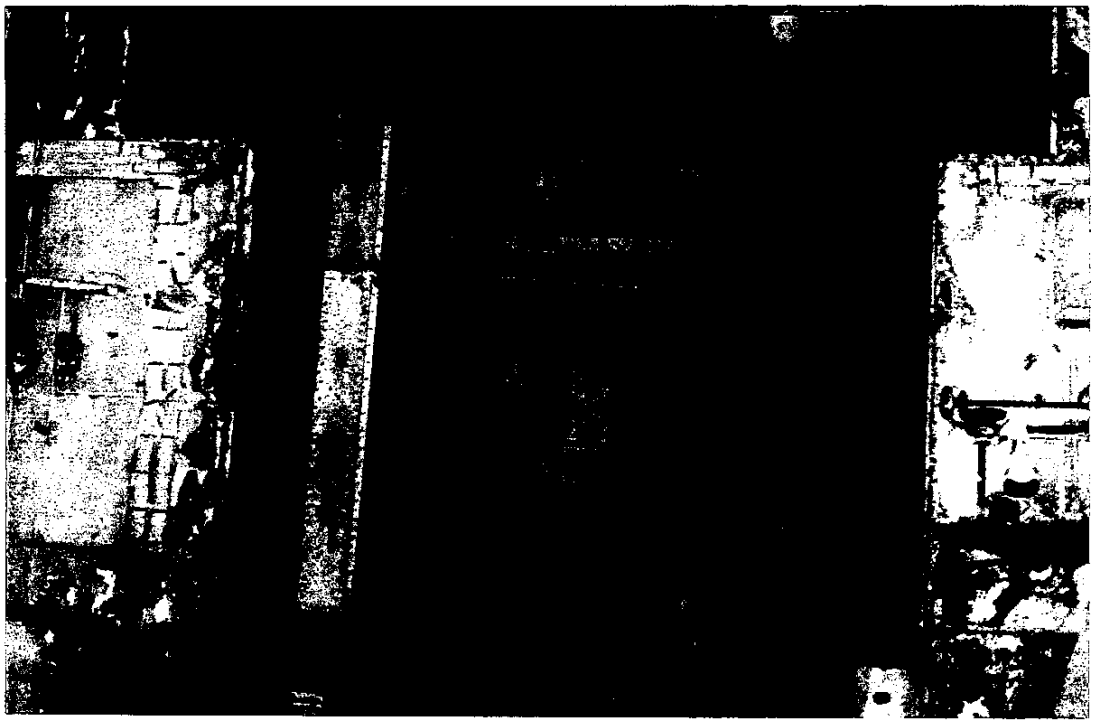
Watertight bulkhead 222 is partially watertight up to the "D"-Deck. Several penetrations are to be blanked-off and collars around bilge pipes and a watertight door is to be installed.

Watertight bulkheads 260 & 311 requires major replacement of plating and stiffeners to "F"-Deck. Installation of a watertight door is required and penetrations blanked-off.

Of the seventeen (17) watertight structural bulkheads in the lower portion of the ship, only two (2) were not modified as a consequence of the conversion modifications. Of the fifteen (15) that were modified, bulkheads 51, 112, 136, 168, 222 and 260 should be repaired/replaced to insure watertight integrity.

Amount **$ 1,890,500.00**

**BULKHEAD 190**
**TYPICAL CONVERSION MODIFICATION**
**TO WATERTIGHT BULKHEAD**



**REMOVED SECTION**
**WATERTIGHT BULKHEAD 244**
**LOOKING AFT TO BOILER ROOM No. 2**

## 3. EXTERIOR DECKS:

### A. REPAIR AND REFINISH

The exterior teak wood decks that have been exposed to the water and weather conditions during the past fifty-six years, have weathered considerably, and caused seepage of moisture through the seams and plugs. This leakage has caused corrosion to the steel decks underneath the wood decking. Even though some of the deteriorated wood has been replaced, it has been reported that leaks appear in compartments below. It is recommended that the balance of the deteriorated teak decks be repaired by removing and replacing of plugs and seam compound and refinishing of the 153,000 square feet of decking.

Amount **$ 710,000.00**

## B. REMOVE AND REPLACE:

1) It is the opinion of the team of engineers that within the next 3 to 5 years the teak-wood decking would be required to be removed and sections of the steel deck plating beneath, be repaired or replaced to eliminate leakage of water into compartments below.

Amount **$ 2,950,000.00**

**SECTION OF REMOVED TEAK DECK SHOWING CORRODED STEEL DECK PLATING**

**SPORTS DECK - WEATHERED TEAK DECK**

2) An option to the removal of teak decking and the replacement of sections of the steel plating underneath, is the installation of new teak decking over the existing decks. This method includes the installation of one (1) inch thick teak decking fastened to the existing decks, fastening holes plugged, and caulking of all seams with weatherproof caulking.

Amount **$ 1,200,000.00**

## C. REPAIRS TO "R" DECK:

All interior decks have been inspected and are (with the exception of a section of the Galley "R" Deck), in sound and good condition with minimum appearance of corrosion. Vinyl floor tile that exists throughout the decking of the Queen Mary contains Asbestos Material and should be replaced with Non-Asbestos Contained Material. The section of the Galley Deck which has deteriorated, requires replacement due to corrosion from water and electrolysis.

Amount **$ 25,000.00**

The Ultrasonic Thickness Measurements for the various steel decks are as follows:

**Area Thickness**

| Deck | Max | Min | Average |
|---|---|---|---|
| "R" | 0.400 | 0.065 | 0.250 |
| Sun | 0.400 | 0.075 | 0.235 |
| Promenade | 0.400 | 0.055 | 0.267 |
| Main | 0.405 | 0.060 | 0.385 |
| "A" | 0.505 | 0.475 | 0.490 |

The minimum thickness readings are from isolated locations on respective decks.

## 4. HULL STRUCTURE EXPANSION JOINTS

The initial design of the Queen Mary incorporated three (3) expansion joints spaced throughout the length of the ship, to absorb the impact and movement of the ships decks and structures from the motions of heavy seas. These three (3) expansion joints running from port to starboard were installed at frame 145 1/2 on the Sun Deck, frame 180 1/2 on the Sun Deck and frame 228 1/2 on the Sports Deck/Sun Deck. Due to corrosion of the steel trough on the underside of the deck joint, water is leaking into the ballrooms and lower compartments.

It is recommended that the deck cover plates be removed, to sandblast and repair the interior of the steel troughs. New overboard discharge lines to be installed and the cover plates reinstalled.

Amount **$ 150,000.00**

## 5. ELEVATORS AND ESCALATOR

It is recommended that the machinery and electrical equipment from seven (7) non-operating elevators be disassembled and removed and replaced with updated components to make fully automated.

The shaft areas of the elevators are coated with Asbestos Containing Material.

This ACM will be required to be removed prior to any performance of work.

One (1) escalator in the convention area has a defective gear box and requires repairs and replacement of parts.

Amount **$ 1,925.000.00**

## 6. ASBESTOS CONTAINING MATERIAL (ACM)

An investigation of available information, specifications and plans, and an inspection of the Queen Mary structures was made to determine an approximate extent of Asbestos Containing Material presently existing aboard the vessel.

The following materials and areas contain ACM:

**Wood Paneling:**

In the construction of the Queen Mary in 1936, the Turner Asbestos Cement Company developed a new fireproof panel called "Turnall Composite Board". This panel consists of a plywood layer, a middle layer of asbestos sheet, and a back layer of plywood. A decorative wood panel was applied over the Turnall Board. All the paneling in staterooms, hallways, lounges, restaurants, etc. contain asbestos containing material.

**TYPICAL PANELING SECTION**
**PROMENADE DECK, PORT SIDE**

**TYPICAL ASBESTOS INSULATION**
**INSIDE WOOD PANELING**

**Ceiling and Wall Insulation:**

Turner Asbestos Cement Company also supplied a "Turnall" asbestos reinforced aluminum foil. This was used to keep temperature fluctuations to a minimum in the center of the structure where boiler up-takes rose through the stacks. There exists unconcealed ACM in the overhead of the boiler rooms, 4" thick spongy blue material sandwiched between steel decks and outer metal or transit coverings.

**Spray-On:**

Spray-on thermal insulation was found in several locations throughout the structure. This material is on fire walls, bulkheads, elevator shafts, support beams, bulkhead penetrations, pipe runs, electrical load centers and on ventilation ducts.

**Engine Room:**

Machinery, equipment, exhaust lines, pipes, and ducting contain Asbestos Containing Material the purposes of reducing temperatures in the engine room areas.

**Electrical Wire Wrap:**

The older electrical wires originally installed, have an asbestos containing white cloth-like wrap. Abandoned wrapped wires can be found in wooden or metal raceways throughout the ship.

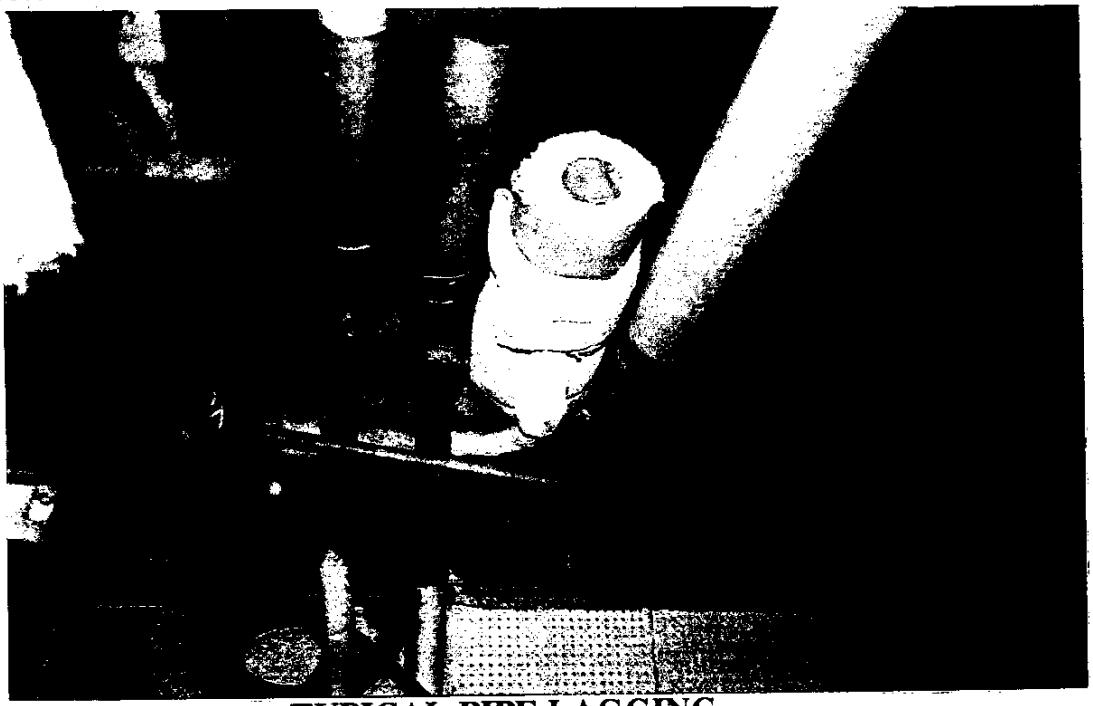
**Vinyl Floor Tile:**

Vinyl floor tile is located in various areas such as lobbies, bathrooms, locker rooms, hallways and kitchens. This floor tile contains asbestos material.

**Boiler Rooms:**

Presently the 46,000 square foot area in the forward boiler and generator rooms has been closed to the public due to exposure of hazardous materials. It is also closed to the crew except for situations which provide for the wearing of proper apparel.

Substantial amounts of asbestos containing material will be required to be removed from the structure both in the overhead panels as well as from the bilge areas, for continued operation of the Queen Mary and for any modification to the structure complex.
***(Note: This item is covered in Section V, item 3)***



**TYPICAL PIPE LAGGING**
**"C" DECK WORKSHOP, PORT SIDE**

As a result of needed repairs performed on a continual basis to specific areas of the structure and systems, ACM will be required to be removed in those areas.

Requirements of regulatory bodies specify that ACM does not need to be removed in those areas that are left undisturbed, and those where ACM is contained and no airborne particles are present.

Amount $ 2,000,000.00

## 7. Handicap Accessibility

An inspection of the Hotel Queen Mary revealed a low level of handicap accessibility to most public spaces. Any future modifications to the structure will be required to be in full compliance with the State Building Code for handicap accessibility.

Amount $ 25,000.00

## 8. Occupant Egress

Signage is to be installed in all passage ways and stairwells to inform occupants of escape routes in case of emergency.

Amount $ 20,000.00

## 9. Pest Control

Fabricate and install approximately 500 port light, (port-hole) screens to eliminate birds from entering.

Amount $ 8,500.00

## 10 Mooring Lines

The inspection of mooring lines indicate a majority of the wire cables require replacement due to corrosion from the saltwater atmosphere. Investigation of all pad eyes and fittings for repairs and replacement, to be performed.

Amount $ 48,000.00

## 11 Life Boats

Repair of the twenty two (22) steel life boats, replace sections of deteriorated bottoms and repaint.

Amount **$ 100,000.00**

# QUEEN MARY
# VESSEL ANALYSIS

## HULL ANALYSIS

## SUMMARY SHEET

| No. Description | Qty | Mat'l | Labor | Immed | Defer | Total |
|---|---|---|---|---|---|---|
| 1. Hull Exterior (Drydock)<br>A Below waterline | | | | | 6,200,000. | 6,200,000. |
| B Above waterline | | | | | 650,000. | 650,000. |
| C Bilge areas | | | | | | SECTION V |
| 2. Watertight Bulkheads | | 200,000. | 1,690,000. | 1,890,500. | ------ | 1,890,500. |
| 3. Exterior Deck<br>A Repair & Refinish | | 150,000. | 560,000. | | 710,000. | 710,000. |
| B. Remove & Replace | | 1,400,000. | 1,550,000. | | 2,950.000. | 2,950,000. |
| C. "R" Deck Repair | | 5,000. | 20,000. | | 25,000. | 25,000. |
| 4. Hull Expansion Joints | | 25,000. | 125,000. | | 150,000. | 150,000. |
| 5. Elevators and Escalator | | | | | 1,925,000. | 1,925,000. |
| 6. Asbestos Containing Material | | | | | 2,000,000. | 2,000,000. |
| 7. Handicap Accessibility | | | | 25,000. | | 25,000. |
| 8. Occupant Egress | | | | 20,000. | | 20,000. |
| 9. Pest Control | | | | | 8,500. | 8,500. |
| 10. Mooring Lines | | | | | 48,000. | 48,000. |
| 11. Life Boats | | | | | 100,000. | 100,000. |
| | | | TOTAL | 1,935,500. | 14,766,500. | 16,702,000. |

# Volume III
# SECTION VII

*QUEEN MARY*

## VESSEL ANALYSIS

## CURRENT
## MECHANICAL AND PIPING SYSTEMS
## REPORT OF FINDINGS

# QUEEN MARY
# VESSEL ANALYSIS

## MECHANICAL AND PIPING SYSTEM

### INTRODUCTION

The Mechanical Systems aboard the Queen Mary were designed by the John Brown Shipyard and installed primarily in the year 1934. During the year of 1967, Rados Engineers boarded the vessel during its second to the last Trans Atlantic Crossing for purposes of determining the condition of the Mechanical Systems. It was determined that the Machinery, Boilers, Air Conditioning Units, Sewage and Piping Systems were severely fatigued and deteriorated, and could not withstand the rigorous requirements of incorporating a Hotel, Restaurant, and Museum for the succeeding Thirty (30) year period.

During the conversion engineering of the Queen Mary in 1967, the Air Conditioning/Refrigeration System was re-designed to ultimately service all the spaces on board the ship. A central chill water plant which has the capacity of 2700 tons of cooling is supplied through sixteen-inch chill-water-mains to the ship. The chilled water is supplied from a Central Plant located on land at Pier J and then piped aboard the Queen Mary.

The Steam System is also supplied from the land based Central Plant at Pier J. The system contains 2 - 800 HP water tube boilers capable of producing 27,500 pounds per hour of 150 lb steam.

The Sewage System consists of a 250 cubic foot collection tank serviced by two 5000 gpm sewage pumps, and a 160 cubic food collection tank serviced by two (2), 200 gpm sewage pumps. PVC pipe has been installed aboard the Queen Mary to replace defective sewage piping. The raw sewage is piped overboard into the City sewer system.

A new Firemain System and Sprinkler Heads were installed during the conversion of the vessel to withstand City pressure requirements.

The Gas Line installed to service the galley's and other special requirements aboard the ship, also originates from city gas lines.

## I. Mechanical & Piping Systems

Since the installation of the mechanical and piping systems in 1968-1971 a minimum of maintenance has been performed on the equipment and piping systems. The equipment and majority of systems after being in operation for the past twenty two years will require major repairs or replacement of equipment and systems. The following information is submitted on the various mechanical and piping systems.

### A. Central Chill-Water Plant and Steam Plant.

The central on-shore energy plant has been designed to provide 2700 tons of refrigeration to the Q.M./Spruce Goose complex as mentioned in the introduction, in addition to a co-generation plant located near the ITS container facility, which is capable of producing 500 tons of refrigeration to the Spruce Goose dome. The 2700 ton capacity plant is provided by three (3) 800 ton units and one (1) 325 ton unit.

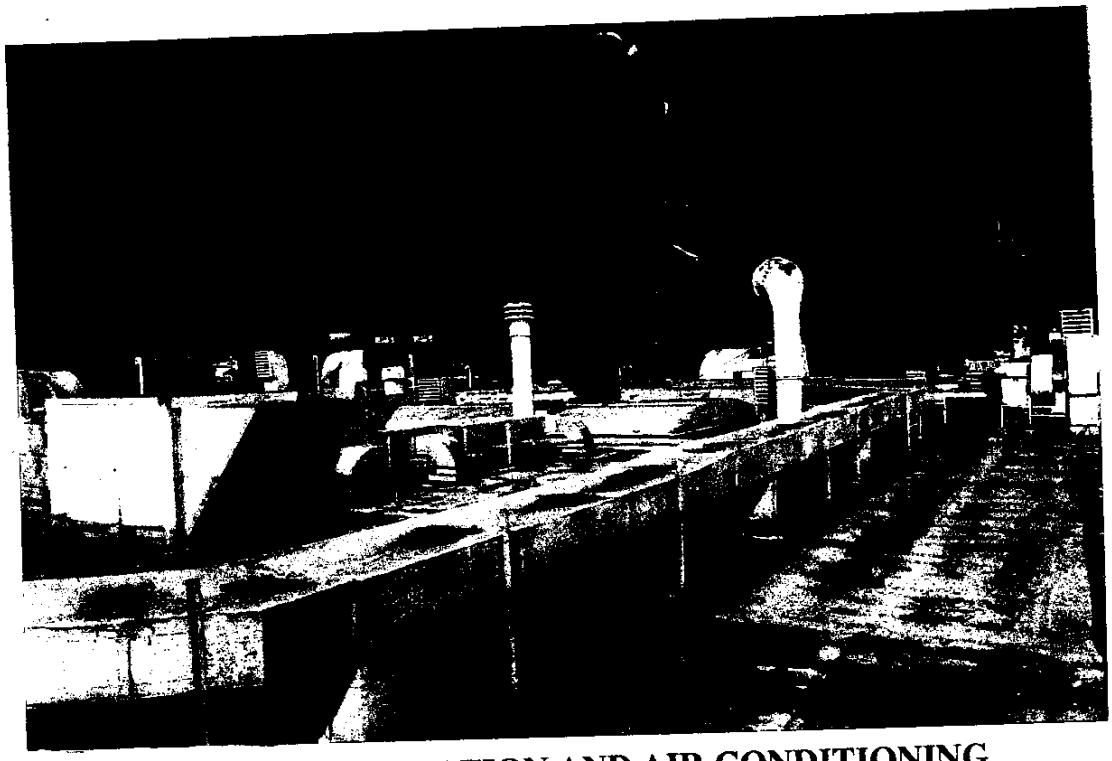
According to figures provided by the current tenant, Disney, the maximum refrigeration load during peak periods has been approximately 800 tons, thus only one of the 800 ton units is needed at any one time to provide for the demand and the rest of the units are on stand-by. Alternating the 800 ton units periodically will provide even wear and tear, and also keeps all units in service.

Steam supply to the Queen Mary is provided by two (2) 800 H.P. water tube boilers located at the central plant with a capacity of 27,500 #/STM/HR @ 150 PSI.

In summary, the central energy plant is more than adequate and in good condition.

### B. Heating, Ventilation and Air Conditioning - Existing Repairs

Due to the limited time frame available, the mechanical survey of shipboard HVAC equipment consisted of a search and review of as-built drawings and diagrams, operating procedures, and a spot-check examination of the supply and exhaust fans, air handling units, fan coil units, chilled water cooling coils, steam heating coils and their associated components.



## HEATING, VENTILATION AND AIR CONDITIONING DUCTING AND COMPONENTS

The approximate total of units presently installed on board the Queen Mary are as follows: (some are disconnected and/or not used).

a. Air Handlers = 33
b. Fan Coil Units =24
c. Supply Fans = 75
d. Exhaust Fans = 74

Due to the age of the equipment and the limited maintenance schedule, the following conditions prevail on an average basis, and are typical for the majority of the 206 HVAC Systems.

1. Air Handlers

a. Excessive corrosion exists around the unit casing and cooling coils (especially units exposed to the weather).
b. Condensate drain pans are corroded and some plugged not allowing proper drainage.
c. Flexible duct connectors have perforations and holes, and in some cases are torn or in a deteriorated condition.

d. Air filters and cooling coil fins are excessively dirty. This greatly reduces air flow.
e. Chilled water piping at many units have missing and/or deteriorated thermal insulation, decreasing efficiency.

2. Fan Coil Units

a. Air filters and cooling coils are excessively dirty. In a few units the air filters are missing.
b. Condensate drain pans are corroding and some are plugged not allowing drainage.
c. Chilled water piping at many units have missing and/or deteriorated thermal insulation.

3. Supply Fans

a. Intake screens are very dirty and in some cases 60% or more clogged with dirt and/or paint which severely restricts the air flow and efficiency.
b. Systems that have heating and/or cooling coils have clogged or missing air filters.
c. Flexible rubberized canvas duct connectors have holes, and in some cases are torn or in a deteriorated condition.
d. Noisy bearings and out of balance fan wheels cause excessive vibration.

**SUPPLY FAN AT FRAME 178**

4. Exhaust Fans

a. Fans installed in weather locations show a lot of corrosion and a need for general clean up maintenance.
b. Flexible rubberized canvas duct connectors have holes, and in some cases are torn or in a deteriorated condition.
c. Noisy bearings and out of balance fan wheels cause excessive vibration.
d. Most of the exhaust fans installed in the weather, discharge vertically with no rain protection. Recommend installing goosenecks in these locations.

5. System Upgrade

To upgrade air conditioning for existing Hotel spaces a total of (18) new Fan Coil Units and their associated piping are to be installed in the following locations:

a. Royal State Rooms
M-121, M-125, M-131, M-135, M-139 and M-141

b. Mini Suites
A-007, A-008, A-125, B-317, B-318, B-424, B-4425, M-017 and M-018

c. Suites
M-102, M-104 and M-106

Amount (1 Thru 5): **$ 726,200.00**

C. Heating, Ventilation and Air Conditioning - System Replacement

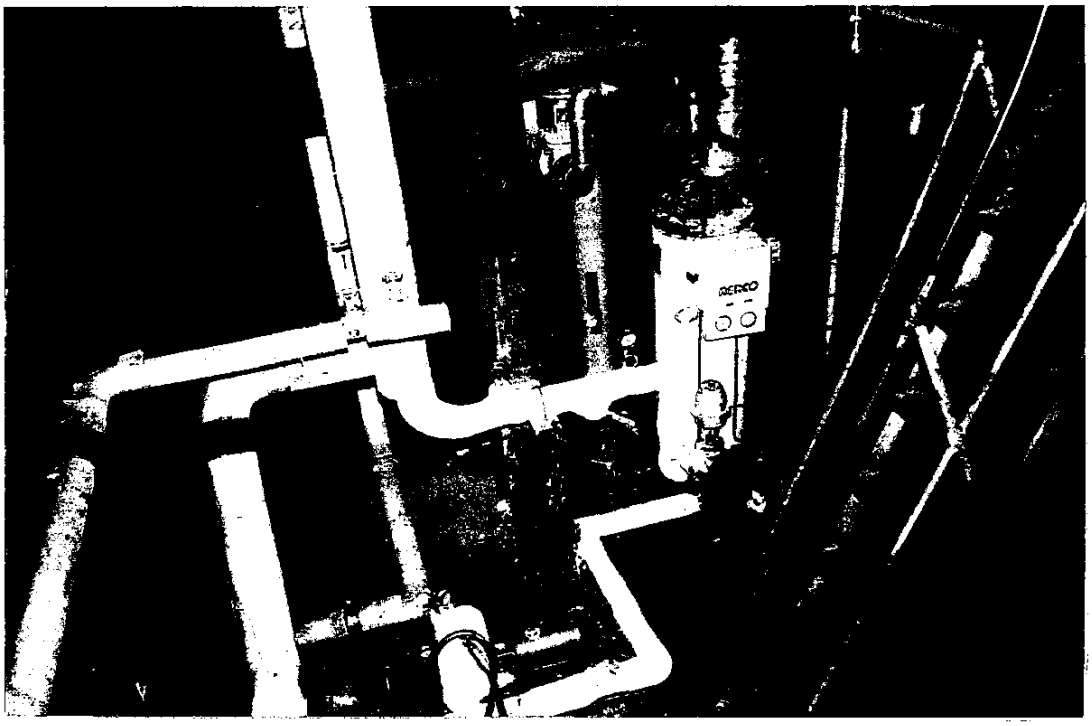
Due to the age of the equipment and limited maintenance performed, a scheduled replacement of the air handlers, fan coil units, supply fans, and exhaust fans should be undertaken within the next 3 to 5 years.

Amount **$ 2,450,000.00**

D. Sewage System

The Ships Sewage is collected throughout the Ship and led to three collection tanks, two located on "F" Deck, Port and Starboard. Each has a capacity of 1870 gallons (250 cu. ft.). Two 500 gpm sewage pumps service each of these tanks. The

third tank is located on "G" Deck at frame 65 centerline and has a capacity of 1197 gallons (160 cu. ft.). This tank is serviced by two 200 gpm pumps which discharge to the Long Beach City sewer system.



**SEWAGE SYSTEM**
**"F" DECK, PORT SIDE**

a) Pumps

Pumps appear to be in good condition, and this is borne out by maintenance personnel. Due to the length of time in use, pumps should be overhauled completely to avoid future problems.

b) Valves

Some sewage system valves show signs of past leaks, others were leaking at the time of inspection, although not seriously. All valves in this system should be refurbished with new gaskets, seats, etc.

c) Piping

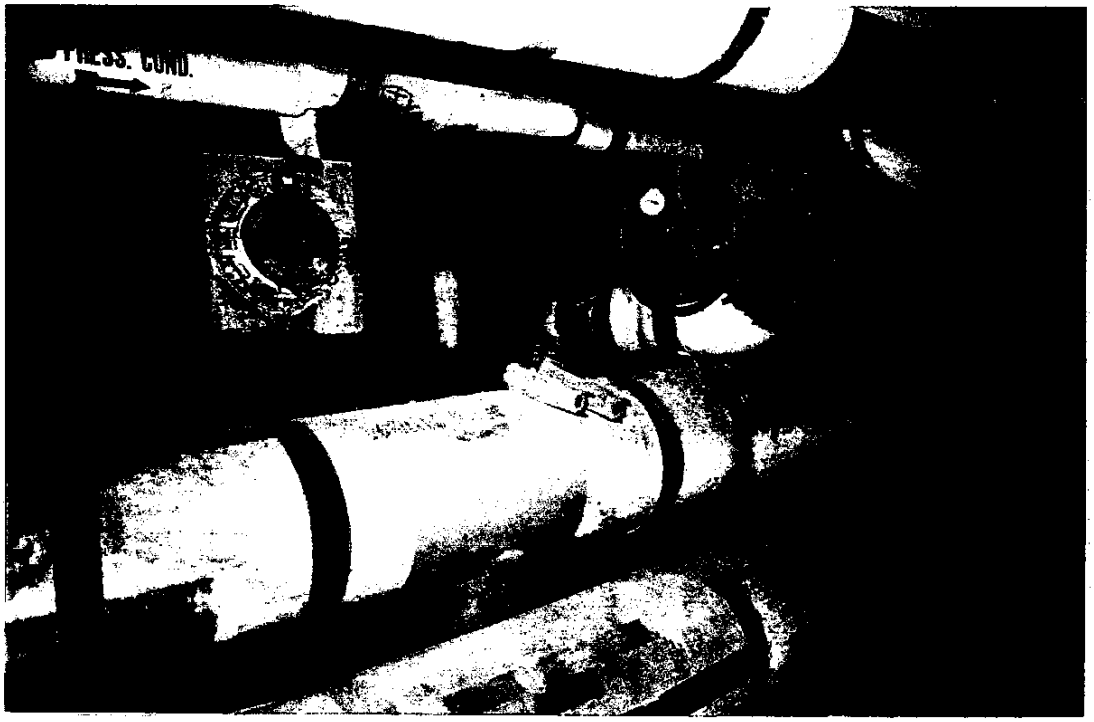
Piping seems to be generally in good condition with a few leaks noted. Some PVC pipe has been replaced with copper pipe. Piping is not

adequately supported by pipe brackets in some areas, particularly in the sewage tank room.

Amount **$ 223,000.00**

E. Steam System

Steam is supplied to the vessel from two 800 H.P. boilers located in the central energy plant on shore for comfort heating, water heating and some cooking equipment.



**PENETRATION POINT**
**FOR MAIN STEAM LINE ENTERING SHIP**

a) Valves

A large portion of the valves throughout the steam system have either leaks through the bonnet or flanges and have deteriorating or missing insulation. Some valves are "frozen". Balancing valves are generally in poor shape and should be either repaired and calibrated or replaced and calibrated. All valves should be checked for proper operation. Pneumatic valve control tubing should be tested, pressures verified and gages calibrated then re-installed.

b) Piping

Steam lines not exposed cannot be assessed for wear without removing insulation, but many sections have insulation missing, exposing leaks and extremely corroded conditions. These conditions occur throughout the ship and in various sizes.

Amount **$ 150,000.00**

F. Firemain System

The Firemain and Sprinkler Systems are served from the shore by separate lines. Both systems after many years of use, should be flushed and hydrostatically pressure tested in their entirety plus perform any other test required by the Long Beach Fire Department. Results of these tests will help determine the condition of the systems and the extent of repairs to be made. Should these tests indicate extensive rework, replacement of all piping may be more cost effective for the long term.

**FIREMAIN AND SPRINKLING MAIN AT POINT OF HULL PENETRATION**

There is presently at least 40 feet of firemain which has developed leaks. This is an indication that further problems will arise in the future, due to the deterioration of the piping.

a) Sprinkler System

Some of the sprinkler heads (approximately 20 percent) are damaged to some extent, and must be replaced. All valves should be checked for leakage and proper operation.

Amount **$ 475,000.00**

b) Replace Firemain System

Due to the age of firemain system and the appearance of water leaks, it is recommended that the firemain be replaced during the next 3 to 5 years. Since the firemain piping penetrates asbestos containing materials, a qualified ACM firm will be required to remove hazardous materials from overhead and side partitions.

Amount **$ 1,950,000.00**

G. Gas Line

The natural gas line serving the Q.M. at present seems to be generally in good condition, but there are some portions on the tower which should be checked by the Gas Company which services the facility.

Amount **$ 5,000.00**

H. Water (Hot/Cold) System

Water is supplied to the vessel from shore via two (2) 6" hoses at "C" Deck. These hoses appear to be in good condition except for an accumulation of marine growth. The hoses should be cleaned and their condition assessed to determine if replacement should be made. A set of spare umbilicals should be made up as specified in part 8 of this report, so that in case of emergency, down time is minimal.

Hot water is served by two Aerco instantaneous water heaters using steam as the heating medium. The piping in the heater spaces appears to be in good condition except for some insulation missing which was being repaired at the time inspection was made.

Water piping is in fair to good condition, but requires a pressure test to locate leaks and defective piping. Control valves not operating properly should be overhauled or replaced. Insulation is missing on some hot water piping.

Amount **$ 202,000.00**

I. Bilge System

The Bilge System, consisting of a main line which runs Fore and Aft with branch lines to various areas of the bilges, is served by three (3) pumps, one (1) forward and one (1) amidship, both on the Port side of the vessel, and one (1) Aft on the Starboard side of the vessel. Two emergency diesel pumps are also located on the ship about "G" Deck level, however only one is connected.

**BILGE PIPING WITH BRANCH LINES TO SUMPS**

a) Pumps

Bilge system pumps (3) have been overhauled and are in good working condition per maintenance people. Rados International Corporation personnel did not observe the pumps in operation. The forward emergency diesel pump at frame 225 is in good condition and is connected to the bilge main and to the ballast system, but a second diesel pump Fwd has not been connected.

b) Piping

Piping installed during the conversion is PVC mixed with steel, and in fair to good condition. All bilge wells are clean and have water to cover the suction strainer. Bilge piping forward of frame 260 is badly corroded, with some sections completely rusted out, making the system inoperative. Some piping has been replaced at some of the bilge wells. Watertight bulkheads which could ordinarily isolate various areas of the bilges are non-existent, subjecting the ship to total flooding in case of a catastrophic disaster.

**PART OF BILGE PIPING SYSTEM**

c) Valves

Bilge suction valves in some areas are "frozen" making them inoperable. All valves must be overhauled to assure they are in proper working order.

Amount **$ 283,000.00**

J. Ballast System

The ballast system presently installed on the ship is connected to the bilge main-header and utilizes the bilge pumps to transfer water to and from 12 individual valved wing tanks, 6 starboard and 6 port. However, this system is not being used. Ballasting is accomplished by using a hosed fill line from the ship's Fire Main into the tanks on "D" deck, and drained by gravity to the sea.

The ballast system as it is now connected lacks the flexibility to make it a viable system. This problem can be corrected by adding seven (7) valves and two (2) short lengths of pipe, which would allow transfer to and from any two tanks.

Amount $ **82,000.00**

K. Deck Drains

Inspections have revealed that some deck drains are partially or completely plugged. It is recommended that the drain pipes be cleaned out to insure free flow from point of origin to terminating point. Provide and install strainer plates at scupper intakes to keep out foreign material and debris.

Further investigations show that several drain pipes have rusted through as a result of the corrosive atmosphere. In order to contain this water from overflowing or entering interior bulkheads and/or overheads, it is recommended that these drain pipes be replaced in areas where pipes have rusted through.

Amount $ **60,000.00**

L. Fire Detection System

The Fire Detection System is outdated and parts are no longer available. The system was last tested in 1990 with few problems reported. However, with limited access and reduced maintenance crews, the possibility exists for a fire to go undetected until it can become a threat to the vessel and the lives of tourist or crew.

It is our recommendation that the Fire Detection System be replaced at this time.

Detailed studies would have to be conducted, but calculating on a square foot area, the cost would be approximately

Amount $ **300,000.00**

M. Public Address System

The P.A. System is outdated as the Fire Detection System, and is not in total working order. This system would be necessary to guide people from the vessel in case of an emergency.

It is our recommendation that this system be replaced at this time.

Detailed studies would have to be conducted, but calculating on a square foot area, the cost would be approximately

Amount $ **150,000.00**

N. Miscellaneous

Replacement of the lavatories in the Capstan Club men's restroom.

Spare hoses utilized for the ship to shore umbilicals, should be made in case of rupture of an existing hose. Should that occur, a spare hose can be immediately put into operation without a costly and timely delay occurring.

An inventory of valves, fittings, pipe, belts, motors, filters, etc., which are more likely to be required, should be provided. Input from maintenance personnel can establish the correct inventory.

Amount $ **200,000.00**

# QUEEN MARY
# VESSEL ANALYSIS

## MECHANICAL

## SUMMARY SHEET

| No. Description | Qty | Mat'l | Labor | Immed | Defer | Total |
|---|---|---|---|---|---|---|
| A. H.V.A.C.-Existing Repairs | | 399,700. | 326,500. | 726,200. | | 726,200. |
| B. H.V.A.C.-System Replaced | | | | | 2,450,000. | 2,450,000. |
| C. Sewage System | | 49,000. | 174,000. | | 223,000. | 223,000. |
| D. Steam System | | 45,000. | 105,000. | | 150,000. | 150,000. |
| E. Firemain System | | 100,000. | 375,000. | 475,000. | | 475,000. |
| F. Firemain Replace | | | | | 1,950,000. | 1,950,000 |
| G. Gas Line | | 1,000. | 4,000. | | 5,000. | 5,000. |
| H. Hot/Cold Water | | 40,000. | 162,000. | | 202,000. | 202,000. |
| I. Bilge System | | 63,000. | 220,000. | | 283,000. | 283,000. |
| J. Ballast System | | 27,000. | 55,000. | | 82,000. | 82,000. |
| K. Deck Drains | | 15,000. | 45,000. | | 60,000. | 60,000. |
| L. Fire Detection System | | | | | 300,000. | 300,000. |
| M. Public Address System | | | | | 150,000. | 150,000. |
| N. Miscellaneous | | | | | 200,000. | 200,000. |
| | | | TOTAL | **1,201,200.** | **6,055,000.** | **7,256,200.** |

# Volume III
# SECTION VIII

*QUEEN MARY*

## VESSEL ANALYSIS

## CURRENT
## ELECTRICAL SYSTEMS
## REPORT OF FINDINGS

# QUEEN MARY
# VESSEL ANALYSIS

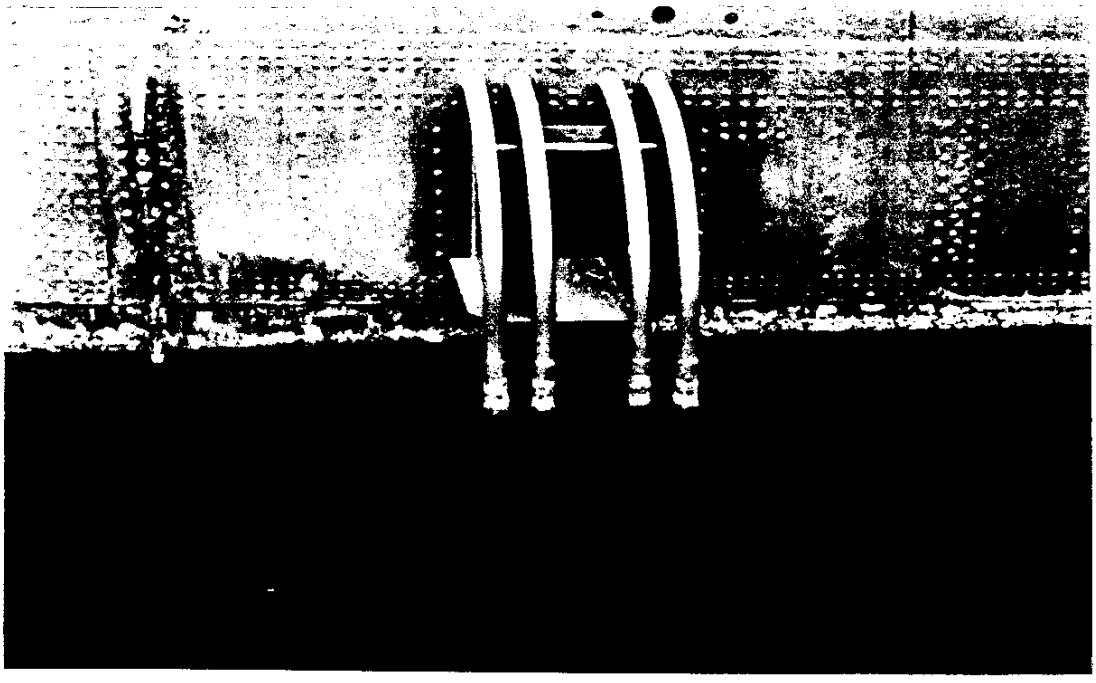
# ELECTRICAL SYSTEM

## INTRODUCTION

The Queen Mary Electrical System was designed and installed by John Brown Shipyards, Clydebank, Scotland during the period of 1934 - 1935. The Ships Generators, Switch-boards, Controllers, Motors and Wiring were designed and installed for direct-current (DC) use. Upon inspection of the Electrical System in 1967, it was determined due to defective wire insulation, wooden distribution boxes, outdated transformers and switchboard panels and aged generators, that the installation of a new electrical systems using alternating-current (AC) aboard the Queen Mary would be required and power use would be provided by Southern California Edison Company.

The feeder lines are connected to two (2) 3750 K.V.A. (Kilo Volt Amp) transformers for a total available capacity of 7500 K.V.A.. These transformers have 12,000 volt primary and 4160 volt secondary capacities.

Power is supplied to the structure at 4160 volts by two (2) main feeders. Each one of the feeders can carry the existing load, thus providing redundancy in the event of failure of one of the feeders.



**MAIN ELECTRICAL SUPPLY FEEDERS TO SHIP**

At the structure, the voltages are stepped down from 4160 to 480 volts at each of the thirteen (13) transformers.

Electrical Substation No. 2 feeds all equipment connected to the Emergency Power Network in the facility. In the event of shore power failure, emergency power is supplied by a Delco Diesel Generator, 500 K.V.A., 480, 3 phase, 60 HZ Delta connection located on "B" deck at frame 19. The emergency power available is utilized primarily for lighting, but includes four (4) sewage pumps and two (2) bilge pumps.

There is an existing spare 750 K.V.A. transformer available for use in the event of failure of existing transformers.

## ASSUMPTIONS AND LIMITATIONS

1. The current connected power (available power) for the facility is 7500 KVA (Kilo Volt Amp).

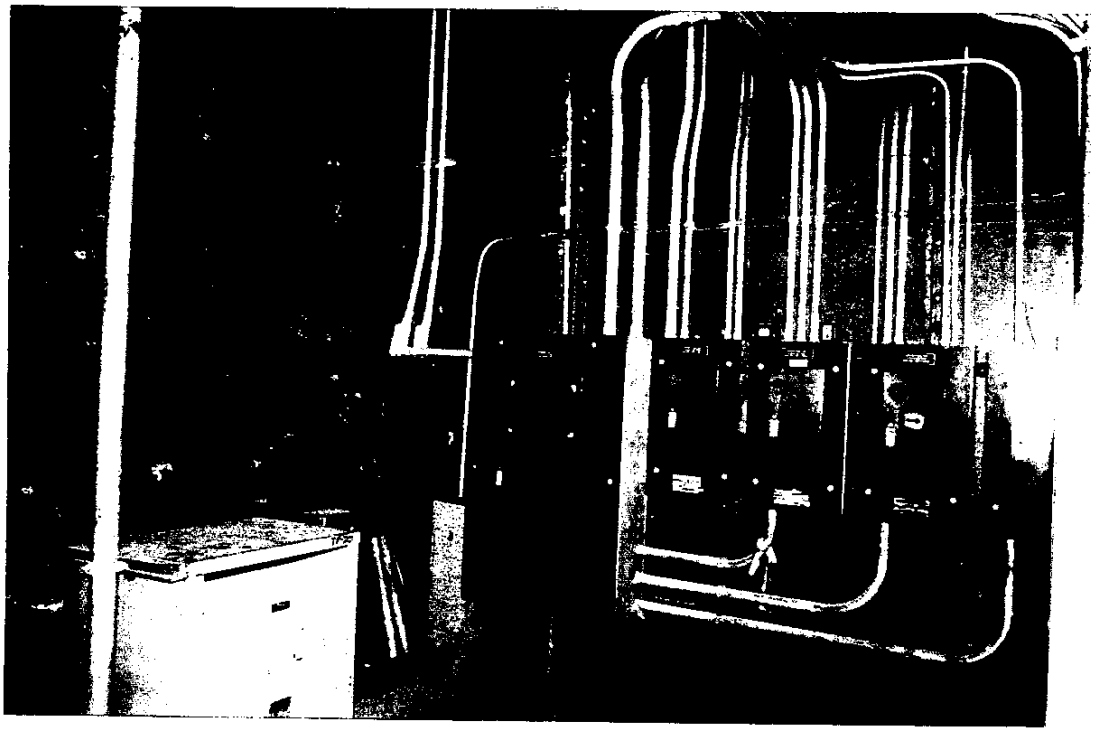
2. The current demand of the facility, taken from reports aboard the vessel, is approximately 2039 KVA or 27% of the total connected capacity.

3. The field research for this report did not include verification of connections for cables or busbars made in the main distribution panels, distribution panels and cable to cable.

## CONCLUSION

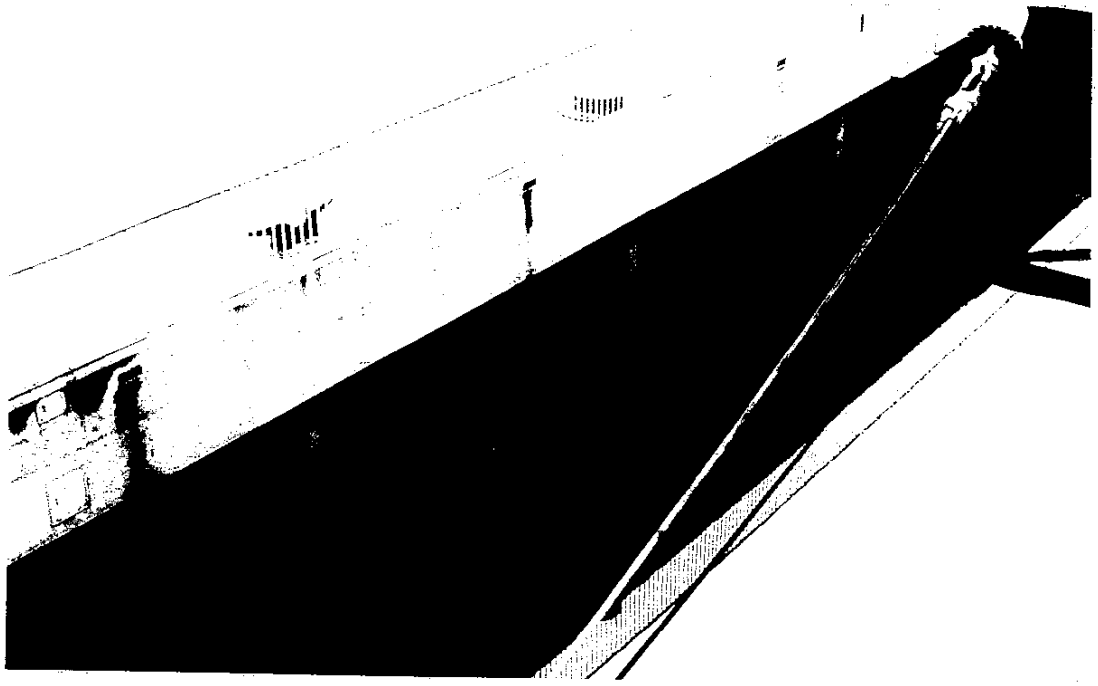
An important goal of the electrical survey was to verify the existance of proper protective devices on the system. Equipment that cannot withstand or interrupt excessive loads, is subject to damage or destruction and poses a threat to surroundings.

Investigations revealed that most of the equipment has the proper overcurrent ratings on the protective devices. Also, there are ground fault indicators throughout the facility which in general are operational. These indicators allow identification of those distribution panels with current leakage that need to be maintained or repaired.



**TRANSFORMER, DISTRIBUTION AND POWER PANEL**

Power is supplied to the Ship by Southern California Edison. These power lines are under utilized at the present and, additional loads can be accommodated with modifications or additional expense.



**PIER SIDE ELECTRICAL MAIN FEEDERS FEEDING SHIP**

The maximum load on any of the thirteen (13) substation transformers located at the facility do not exceed 30% of their capacity. At the present there is no demand charge (fee for under utilizing equipment). However, this condition could change at the discretion of SCE. Should demand charges be required in the future, modifications to the electrical distribution system would be recommended to minimize charges.

Some of the equipment associated with each substation includes:

1) Distribution panel boards
2) Transformers
3) Disconnects
4) Circuit Breakers
5) Capacitors
6) Cables
7) Conduit
8) Motors

In general the electrical equipment is approximately (20) twenty years old and in fair condition. However, the main breaker at each of the thirteen (13) load centers are no longer manufactured. Finding parts for replacement is difficult. We recommend the replacement of all the main breakers.

Most of the breakers have not been tested internally to ensure proper operation when needed. We recommend infrared testing and mechanical testing for breakers 200 AMPS or larger.

The existing emergency generator should be tested under a full load condition to ensure proper operation when needed.

All of the electrical rooms have only one exit. We recommend the installation of an additional exit at each location housing a main distribution panel in order to provide an alternate exit as required by code.

Some of the most frequent problems encountered throughout the facility are:

a) Inadequate lighting - 70 locations
b) Oversized breakers - 10 locations
c) Exposed connections - 4 locations
d) Deteriorated equipment - 6 locations
e) Equipment inaccessibility - 10 locations

A. Electrical System Repairs:

1. Emergency Generator service, repair and check-out.

Amount $ 15,000.00

2. Install a second exit in all electrical rooms.

Amount $ 7,575.00

3. The following list describes the deficiencies, categorized by substation.

A. Substation No. 1 L.C. B-114-2
- Replace main circuit breaker
- Setting on main circuit breaker is 1600 A. Reset to 800 A.

B. Substation No. 2 L.C. B-19-2E (Emergency)
- Replace main circuit breaker
- Complete Emergency system test
- Panel 1319 "S" Deck - service area around unit
- Panel 1323 "C" Deck - panel lighting

C. Substation No. 3 L.C. A-112-2
- Replace main circuit breaker
- Panel 715 "R" Deck - panel lighting

D. Substation No. 4 L.C. B-112-2
- Replace main circuit breaker

E. Substation No. 5 L.C. F-85-2
- Replace main circuit breaker
- Panel 523, 523B, 526 & 527 poor condition, replace
- Lighting at panels, 8 locations
- Panel 510 is not accessible

F. Substation No. 6 L.C. S-107-2
- Replace main circuit breaker
- Substation in poor physical condition, refurbish

- One oversized circuit breaker, replace
- Lighting at panels, 9 locations
- Ventilation at panel 1227 and 1240

G. Substation No. 7 L.C. M-100-1
- Replace main circuit breaker
- Panel 604, 200 AMP circuit breaker, 135 AMP wire
- Lighting at panels, 10 locations

H. Substation No. 8 L.C. F-165-2
- Replace main circuit breaker
- Lighting at panels, 6 locations

I. Substation No. 9 L.C. M-230-1
- Replace main circuit breaker
- Circuit breaker ratings panel 363 & 386, replace
- Lighting at panels, 12 locations

J. Substation No. 10 L.C. B-19-2
- Replace main circuit breaker
- Service area around panel 1319
- Lighting at panels, 5 locations

K. Substation No. 11 L.C. P-143-1
- Replace main circuit breaker
- Circuit breaker ratings, 4 locations, replace
- Panel 1124, poor physical condition

L. Substation No. 12 L.C. SP-202-2
- Replace main circuit breaker
- Service area around panels, 4 locations
- Lighting at panels, 13 locations
- Ventilation, panel 114

M. Substation No. 13 L.C. R-241-2
- Replace main circuit breaker
- Circuit breaker rating, panel 241, replace

- Exposed connections, 3 locations
- Lighting at panels, 6 locations
- Service area around panel, 2 locations

Amount $ 98,825.00

The maintenance aboard the vessel is ongoing and some items listed above may have been corrected by the time the Port of Long Beach reaches a decision as to the disposition of those items. However, the information in this report is accurate at the time of the investigation on the vessel.

## ESTIMATED COSTS (MODIFICATIONS AND REPAIRS)

The following pages contain the estimated costs to accomplish the necessary modifications and repairs.

The large majority of repairs fell into a finite number of similar repair type requirements allowing several portions of the scope to be estimated with general allowance type costs. Specialized repairs were treated separately.

This estimate was prepared without the benefit of any formalized engineering such that scope assumptions had to be employed as to layout, method, material specifications and setup.

Estimating unit manhour productivity was derived with consideration for the fact that the work is to be performed in discrete locations separated in space such that production type installation is impossible.

Some basic assumptions are as follows:

- Lighting fixture additions will intercept existing circuits.
- Improperly sized circuit breakers shall be replaced.
- Inadequately ventilated electrical rooms will have exhaust fans installed.
- Load center main circuit breaker replacements will be Westinghouse molded case type.

# QUEEN MARY
# VESSEL ANALYSIS

## ELECTRICAL

## SUMMARY SHEET

| No. | Description | Qty | Mat'l | Labor | Immed | Defer | Total |
|---|---|---|---|---|---|---|---|
| 1. | Emergency Generator Repair and Service | | 5,000. | 10,000. | 15,000. | | 15,000. |
| 2. | Electrical Sub-Stations and Auxiliaries | | 65,900. | 32,925. | 98,825. | | 98,825. |
| 3. | Second Exits in Electrical Rooms | | 3,575. | 4,000. | | 7,575. | 7,575. |
| | | | | **TOTAL** | **113,825.** | **7,575.** | **121,400.** |

# Volume III
# SECTION IX

*QUEEN MARY*

**VESSEL ANALYSIS**

## MAINTENANCE COSTS FOR THE HULL STRUCTURE, MECHANICAL AND PIPING SYSTEMS, AND ELECTRICAL SYSTEMS

# QUEEN MARY
# VESSEL ANALYSIS

# VESSEL MAINTENANCE

## INTRODUCTION

The importance of an established preventative maintenance program is an area that cannot be overstated. During the years of operation following the conversion there was some confusion between the leasee and the City/Port regarding maintenance responsibility. This confusion and the lack of a definitive maintenance schedule caused the general deterioration of the vessel.

This condition eased somewhat after the Disney Corporation acquired the lease of the facilities, a maintenance program was established and many needed repairs were performed. However, even an efficient repair and maintenance program cannot overcome numerous years of neglect. As a result, a major renovation program is required to upgrade these systems and structure that have received little attention before a maintenance program can be effective.

The purpose of this section is to address those areas requiring consideration in developing a preventative maintenance program. The items listed in this section represent some of the items which must be incorporated into the program, but does not represent a complete list.

In the outline of a maintenance program, it has to be assumed that at least some of the items of renovation have been completed, since a maintenance program cannot effectively deal with the labor and logistics of major renovations or improvements.

It should be pointed out that the deterioration rate of a structure floating in salt water, with all interior areas open and subject to the effects of the salt water environment, is not significantly different from that of an operating vessel. The major difference being that an operating vessel has a large crew that maintains the vessel around the clock.

Based upon the existing conditions and uses aboard the Queen Mary structure, the following maintenance cost for Hull Structure, Machinery, Piping, and Electrical Systems are as follows:

## HULL AND STRUCTURAL MAINTENANCE

Maintenance of the hull, internal structural members, bulkheads, deck plating, wood paneling, wood decking, and inspection of rigging, utilizes both a scheduled maintenance and a mandatory periodic visual inspection of all exposed surfaces and structures which are non-mechanically and non-electrically related.

During the construction of the vessel which began in 1931, the creation of thousands of compartments both large and small were constructed within the shell of the hull and the superstructure. Many of these compartments have been neglected especially in the lower and after sections of the vessel.

Maintenance of the structural portion of the vessel is comprised mainly of re-painting of the steel and wood elements of the ship and in some cases, sandblasting or hydroblasting prior to the recoating. In view of the square footage located between the thirteen (13) decks and including the exterior masts, funnels, deck equipment and life boats, the task is significant in scope. The maintenance of the painting and upkeep of the loading ramps and gangways, the breasting structures, mooring lines/cables and visual inspections of the cathodic protection system including readings from it's six rectifiers are included in the maintenance program.

Included in the hull maintenance is the lubrication of staying wires and cables, tightening of loose nuts and bolts, removal of debris, replacement of defective overhead panels, and the ordering and stocking of appropriate maintenance materials.

Prior to any repairs to machinery, piping, or electrical systems, the hull maintenance group might be required to remove existing panels or like interferences in order to allow the mechanical and electrical maintenance groups to perform their maintenance tasks.

In determining the maintenance cost for the Hull and Structure Group, it is assumed that all the immediate and deferred items listed in Section VI are completed and therefore the following minimum amount of labor and materials are required.

| | | |
|---|---|---|
| LABOR | $ 600,000.00 | |
| MATERIAL | $ 1,425,000.00 | |
| | TOTAL | **$ 2,025,000.00** |

If the immediate and deferred items are ***not*** completed the maintenance cost would be as follows:

| | | |
|---|---|---|
| LABOR | $ 1,261,850.00 | |
| MATERIAL | $ 2,788,150.00 | |
| | TOTAL | **$ 4,050,000.00** |

## MECHANICAL SYSTEM MAINTENANCE

All mechanically operated system components and devices must be serviced periodically on a scheduled basis to insure the accurate, dependable and satisfactory performance required of the components and controls. Proper operating condition of components and systems, affects not only the system's operation but more importantly the useful life of the component. Because of the salt water environment, some items need more frequent attention, especially those open to the weather.

The large amounts of mechanically operated system components aboard the Queen Mary along with the varied types and sizes of units, present a tremendous maintenance challenge. Practically all spaces of the 1,018' long by 118' wide vessel, along with the thousands of compartments located within the thirteen (13) decks, contain serviceable system components.

Those emergency systems that affect the safety of personnel aboard the vessel such as the Fire Protection System and the Public Address System, require special attention so that in case of emergency, the prevention of injury and the loss of life is minimized. The successful performance of emergency related systems in actual emergencies, provides psychological comfort to guest and personnel and limits the legal exposure to owners and operators. Other mechanical systems such as the Environmental Control System (ECS), the Sewage System and the Compressed Air System while vitally as important for the successful day to day operation, do not demand the high degree of responsibility and accuracy of system maintenance.

In implementing an effective maintenance program, it is essential that responsible maintenance be performed by knowledgeable, qualified, and dedicated maintenance personnel. Many problems that are encountered are the result of responsible maintenance decisions as opposed to lack of system knowledge.

The following systems and their components require scheduled maintenance and system testing as required by the manufacturer of each system component which obviously vary, and comprise the estimated costs as follows:

a). Firemain & Sprinkling System and Alarm System
b). Valves & Piping
c). Bilge System
d). Sewage System
e). Compressed Air System
f). Environmental Control System (HVAC)

1. Chill Water System
2. Steam System
3. Pneumatic Controls/Actuators
4. Air Handling
5. Fan Units
6. Compressors/Condenses

g). Hot and Cold Fresh Water System
h). Public Address System

Prior to any repairs to the machinery, piping systems, the hull maintenance group would be required to remove wood paneling and like interferences to allow the mechanical maintenance group to perform their maintenance tasks. The group would also be required to order and stock appropriate maintenance materials. The testing and inspection of all systems is included.

In determining the maintenance cost for the Mechanical Group, it is assumed that all the immediate and deferred items listed in Section VII are completed and therefore the following minimum amount of labor and materials are required:

| | | |
|---|---|---|
| LABOR | $ 817,825.00 | |
| MATERIAL | $ 1,952,333.00 | |
| | TOTAL | **$ 2,770,158.00** |

If the immediate and deferred items are ***not*** completed the maintenance cost would be as follows:

| | | |
|---|---|---|
| LABOR | $ 2,523,710.00 | |
| MATERIAL | $ 3,016,260.00 | |
| | TOTAL | **$ 5,540,000.00** |

## ELECTRICAL ESTIMATED COSTS

The following list represents the minimum required maintenance for the electrical system and components. As a developing Preventative Maintenance Program is initiated, items pecular to a specific vessel will arise and should be added to the Maintenance Program. This list is derived from industry practice and ANSI/IEEE recommended practice and is comprised of the following:

ANNUAL

- Circuit breaker cleaning, testing, inspection and tightening.
- Emergency generator for full load 2 hr test.
- Infrared testing of circuit breaker loading.

TRI-ANNUAL

- Circuit breaker cleaning, testing, inspection and tightening.
- Emergency generator full load 2 hr. test.
- Infrared testing of circuit breaker loading.
- Ground detector light functional check.
- Ground resistance continuity check.
- Test Transformer Insulation (duble testing).
- Conductor insulation testing.
- Motor control center checkout and large motor overload tests.

The estimated costs for all of the above maintenance was derived from documents and report aboard the vessel. Circuit breaker detailed testing, is to be performed on all breakers 200 AMPS and larger. Cleaning and visual inspection will be performed on all circuit breakers on a load center basis.

Test and inspection prices were derived from documents and reports aboard the vessel.

| | |
|---|---|
| LABOR | $ 38,175.00 |
| MATERIAL | $ 20,000.00 |
| TOTAL | $ **58,175.00** |

# QUEEN MARY
# VESSEL ANALYSIS

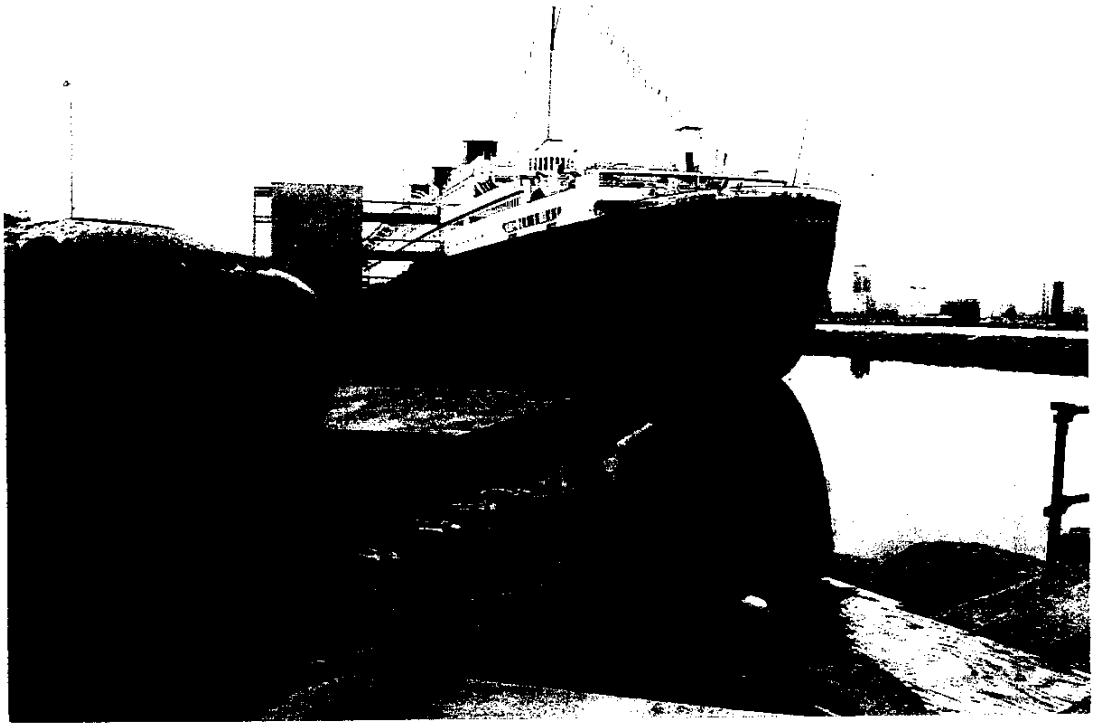
## MAINTENANCE COSTS

## SUMMARY SHEET

| No. | Description | Qty | Material | Labor | Total |
|---|---|---|---|---|---|
| 1. | Hull Structure | | 1,425,000.00 | 600,000.00 | 2,025,000.00 |
| 2. | Mechanical Piping Systems | | 1,952,333.00 | 817,825.00 | 2,770,158.00 |
| 3. | Electrical System | | 20,000.00 | 38,175.00 | 58,175.00 |
| **TOTAL** | | | **3,397,333.00** | **1,456,000.00** | **4,853,333.00** |

Maintenance is by nature, "Deferred", however ignored maintenance will become major repair items later.

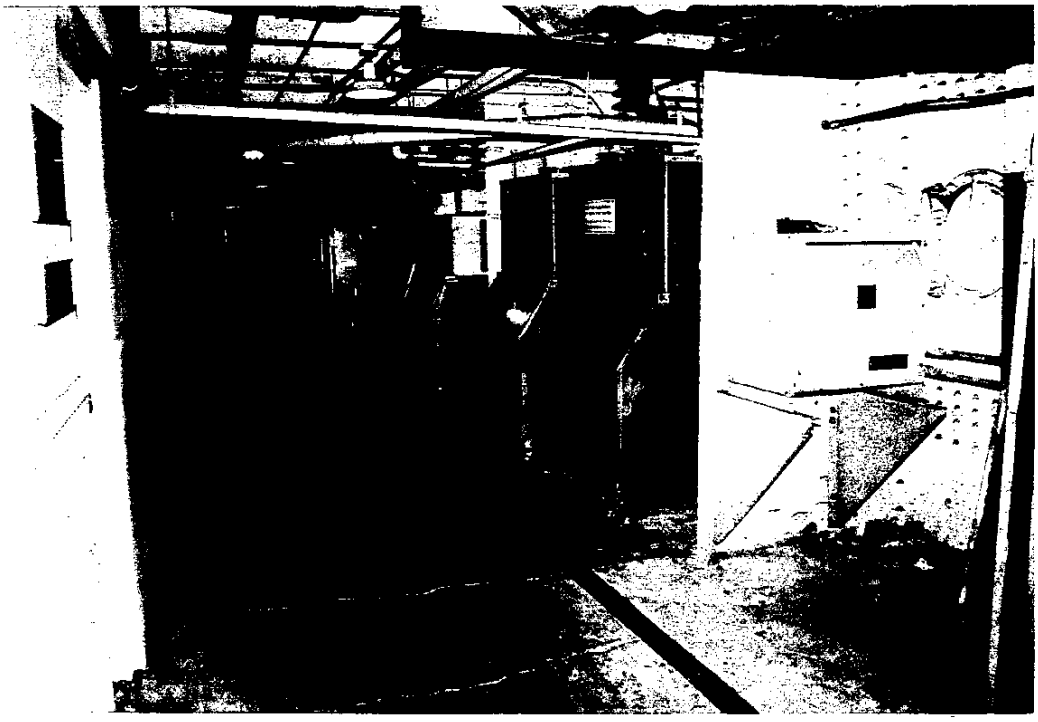
The Material costs listed above, include those items for which outside contractors must be used.



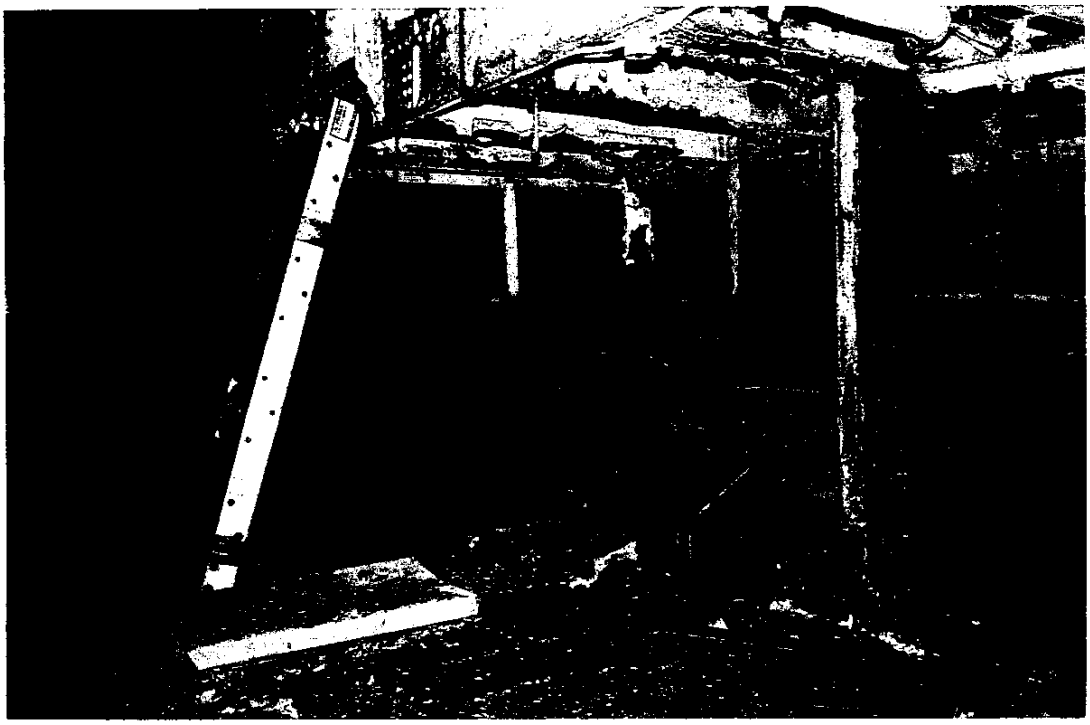
MOORING LINES/CABLES

EMERGENCY EXIT GANGWAY

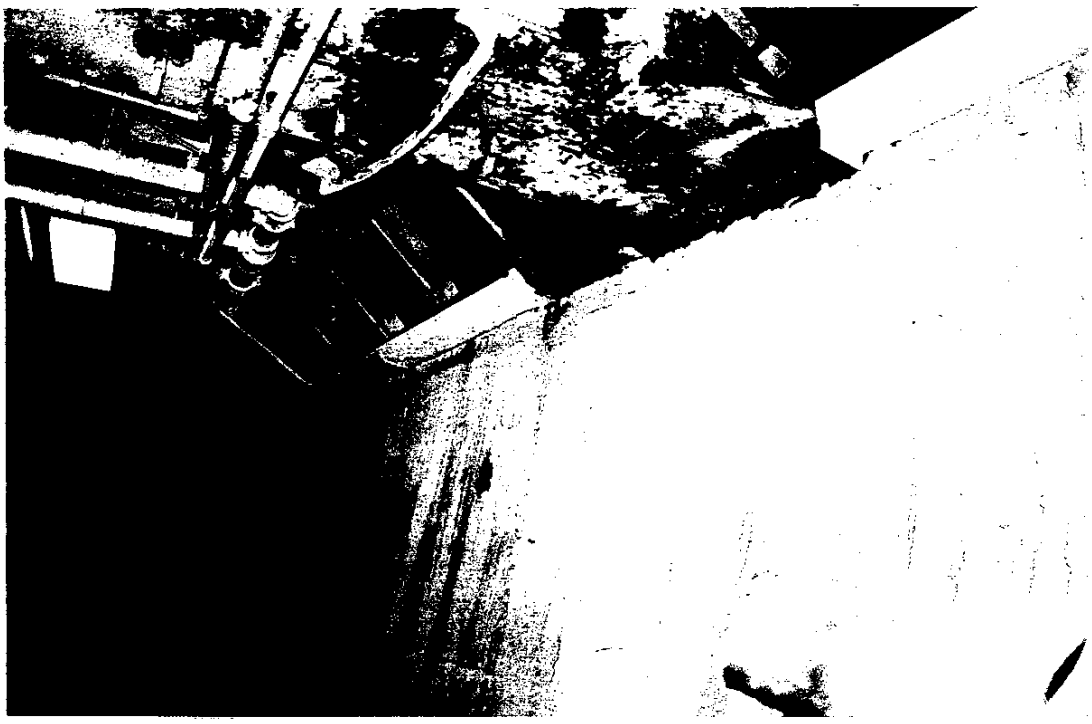
TYPICAL
EXPANSION
JOINT



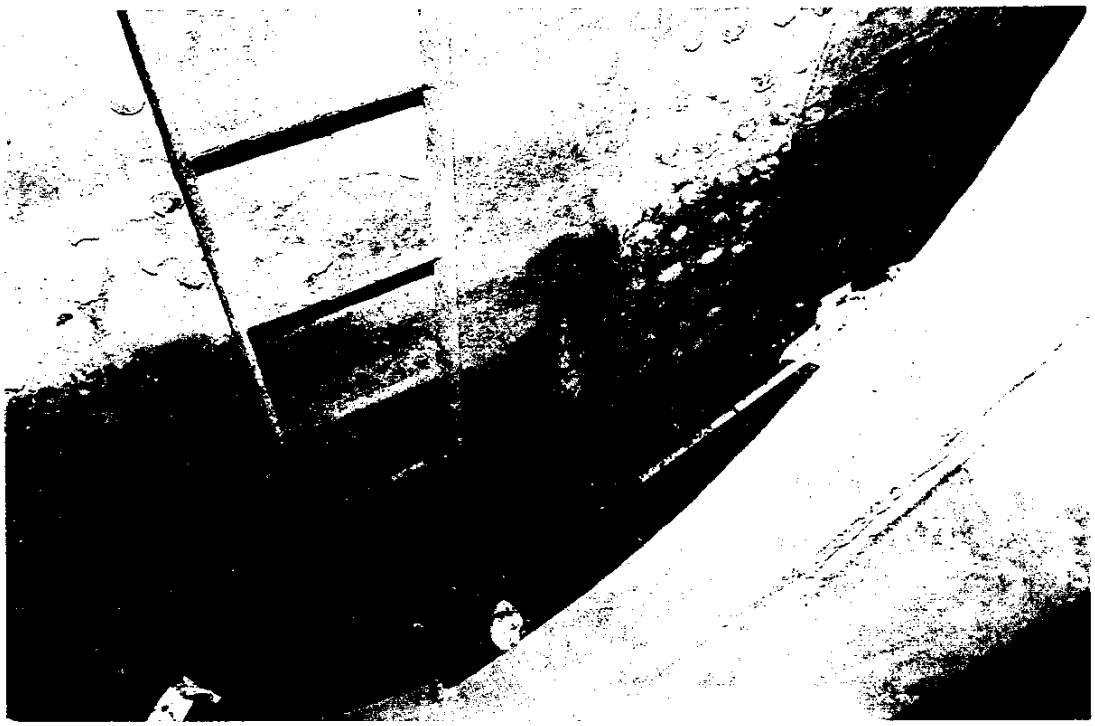
"R" DECK
PASSAGEWAY
PORT SIDE



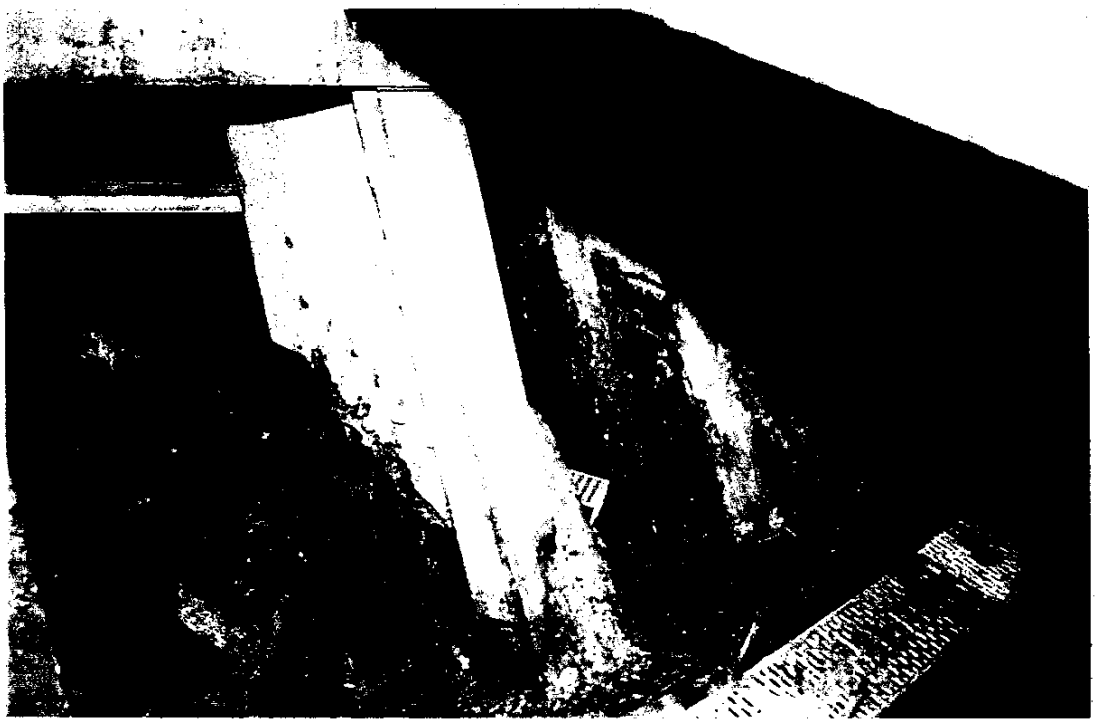
FUNNEL No.1 UPTAKE - "D" DECK, PORT SIDE



PASSAGEWAY, "F" DECK TO "E" DECK, POST SIDE, AFT



BILGE AREA, PORT SIDE, AFT



SHAFT BILGE AREA, STBD SIDE

# Volume III
# SECTION X

## *QUEEN MARY*

## VESSEL ANALYSIS

## ALTERNATIVE USES FOR THE QUEEN MARY

# QUEEN MARY
# VESSEL ANALYSIS

## ALTERNATE USES

Economics Research Associates has been authorized by the City of Long Beach to develop alternative use concepts for the Hotel Queen Mary complex. Rados International Corporation has investigated the following concepts and are submitting a rough order of magnitude for design and construction.

**Alternative No. 1** Night-time Entertainment Center

**Alternative No. 2** Card Club Combined with Entertainment Center

**Alternative No. 3** Shore Based Maritime Museum with Mini-Tour of Ship

The following narrative on the revised alternative uses is separated into the three options as listed above. The "fit-out" would include: interior finishes, floors, walls, ceilings, all furnishing, fixtures, equipment, and props and dressings. These cost estimates were provided by entertainment cost consultant David Holtz. The "structural" would include those costs to develop the area to be fitted.

**Alternative No. 1 Night-Time Entertainment Center**

1. The Observation Lounge would be converted into a 4600 square foot Music Club, Jazz. No structural changes are required. Engineering services required.

| | |
|---|---|
| A. Engineering Services | $ 4,500. |
| B. Fit-Out: (Holtz) | $ 460,000.00 |
| TOTAL | $ **464,500.00** |

2. The Queen's Lounge would be converted into a 4600 square foot dinner theater. The wood paneling and dommed ceiling are far too unique and will not be changed. There will be no structural changes required.

| | |
|---|---|
| A. Engineering Services | $ 2,000.00 |
| B. Fit-Out: (Holtz) | $ 480,000.00 |
| TOTAL | **$ 482,000.00** |

3. The Royal Salon, combined with the King's View Room would be converted into a 4000 square foot sports bar.

   A. Structural changes to remove 33-42 feet of bulkhead and between the two spaces.

   This bulkhead is a primary structural member and therefore, it will be replaced with a longitudinal girder and retain the two web frame supports.

| | |
|---|---|
| Material | $ 5,000.00 |
| Labor | $ 20,000.00 |
| A. Total | $ 25,000.00 |
| B. Fit-Out: (Holtz) | $ 500,000.00 |
| TOTAL | **$ 525,000.00** |

4. The Wedding Chapel, combined with the Victorian Room would be converted into a 3300 square foot Magic Club.

   A. Structural Changes to remove 30 feet of bulkhead between the two spaces.

   This bulkhead is a primary structural member and therefore, it will be replaced with a longitudinal girder and retain the web frame supports.

| | |
|---|---|
| Material | $ 4,000.00 |
| Labor | $ 19,000.00 |
| A. Total | $ 23,000.00 |
| B. Fit-Out: (Holtz) | $ 363,000.00 |
| TOTAL | **$ 386,000.00** |

5. The Prom Cafe and Lounge, 4100 square feet, will be retained but the theme and decor will be changed.

| | |
|---|---|
| A. Engineering Services | $ 3,850.00 |
| B. Fit-Out: (Holtz) | $ 600,000.00 |
| TOTAL | **$ 603,850.00** |

6. The Chelsea Restaurant, 2000 square feet, would be retained but the theme and decor will be changed.

| | |
|---|---|
| A. Engineering Services | $ 2,000.00 |
| B. Fit-Out: (Holtz) | $ 300,000.00 |
| TOTAL | **$ 302,000.00** |

7. The Brittania Salon would be converted into a 9000 square foot Comedy Club.

| | |
|---|---|
| A. Engineering Services | $ 4,500.00 |
| B. Fit-Out: (Holtz) | $ 990,000.00 |
| TOTAL | **$ 994,500.00** |

8. The Veranda Grill would be converted into a 4000 square foot Music and Dance Club.

| | |
|---|---|
| A. Engineering Services | $ 2,500.00 |
| B. Fit-Out: (Holtz) | $ 400,000.00 |
| TOTAL | **$ 402,500.00** |

9. The Sun Deck Museum Area, 15000 square foot, will be retained. About 10% of the display area and displays will be changed. Renovate all displays, clean and paint area.

**$ 200,000.00**

10. The Sir Winston Room, 3500 square foot, will be retained and refit.

| | | |
|---|---|---|
| A. Engineering Services | $ 5,000.00 | |
| B. Refit, Refresh, Interior Decor | $ 75,000.00 | |
| Upgrade Kitchen Equip & Paint | $ 75,000.00 | |
| | TOTAL | $ **155,000.00** |

11. Promenade Deck Retail Shops (11,000 square feet).
    - Retain Shops in Piccadilly Circus
    - Enlarge Shops, Port Side, with displays and doors to Promenade Deck.

    a) "Royal Insignia" (men's store) and "Bit of Britain" (souvenir shop) have been enlarged and are open to the promenade.

    b) "Royal Crystal" shop can be enlarged by deleting bulkheads at frame 243 and 246 to include the spaces now used as a men's restroom and an unassigned office.

    Note: A large vent trunk (approx 6' x 6') penetrating through should not be disturbed.

    Enlarge the door opening to the promenade at frame 241.

    Replace door at frame 247 with display window and add two more windows to frame 250.

    Add display windows to promenade between frames 236-239, to passage between frames 243-246.

    New shop area (including existing storage) approximately 925 square feet. (Net gained; about 350 square feet)

| | | |
|---|---|---|
| A. Structural Mods | $ 60,000.00 | |
| B. Basic Interior | $ 30,000.00 | |
| (Not including Tenant improvement) | | |
| | TOTAL | $ **90,000.00** |

12. Enlargement options - Add 300 square feet of dining to Sir Winston Room. Aft, outboard, corner, port and starboard of this space, there are bulkheads around the mast shrouds. This space, port and starboard, could be opened up for use by shortening the shrouds and re-attaching to new chain plates on the extended deckhouse structure.

| | | |
|---|---|---|
| A. | Srtuctural/Rigging | $ 75,000.00 |
| B. | Fit-Out: | $ 75,000.00 |

TOTAL $ **150,000.00**

**GRAND TOTAL: $ 4,949,550.00**

**Alternative No. 2 - Card Club combined with Entertainment Center.**
The items listed in Alternative No. 1 would be the same for this alternative with the exception of item No. 1, the Observation Lounge would be converted into a Comedy Club and No. 6 the Brittania Salon would be converted into a Card Club. The following is a list of only those changed items.

1. The Observation Lounge would be converted into a 4600 square foot Comedy Club. No structural changes are required.

| | | |
|---|---|---|
| A. | Engineering Services | $ 5,000.00 |
| B. | Fit-Out: (Holtz) | $ 506,000.00 |

TOTAL $ **511,000.00**

6. The Brittania Salon would be converted into a 9000 square foot Card Club.

| | | |
|---|---|---|
| A. | Engineering Services | $ 10,000.00 |
| B. | Fit-Out: (Holtz) | $ 1,080,000.00 |

TOTAL $ **1,090,000.00**

**Alternative No. 3 - Maritime Museum Ashore with Mini-Tour on the vessel.**

| | | |
|---|---|---|
| A. | Engineering Services | $ 6,000.00 |
| B. | Re-Fit | $ 44,000.00 |

TOTAL $ **50,000.00**

The configuration of the Queen Mary to be modified to incorporate the following alternative uses.

**Alternative No. 1** Night-time Entertainment Center

| | |
|---|---|
| Amount | $ 4,809,550.00 |
| With Enlargment Option | $ 4,959,550.00 |

**Alternative No. 2** Card Club Combined with Entertainment Center

| | |
|---|---|
| Amount | $ 4,939,550.00 |
| With Enlargment Option | $ 5,089,550.00 |

**Alternative No. 3** Shore Based Maritime Museum with Mini-tour of Ship

| | |
|---|---|
| Amount | $ 50,000.00 |

# QUEEN MARY
# VESSEL ANALYSIS

## ALTERNATE USES

## SUMMARY SHEET

| No. | Description | Engr | Structural | Fit-Out | Total 1 | Total 2 |
|---|---|---|---|---|---|---|
| 1. | Observation Lounge<br>Music Club, Jazz | 4,500.00 | | 460,000.00 | 464,500.00 | |
| 2. | Queen's Lounge<br>Dinner Theater | 2,000.00 | | 480,000.00 | 482,000.00 | 482,000.00 |
| 3. | Royal Salon<br>Sports Bar | | 25,000.00 | 500,000.00 | 525,000.00 | 525,000.00 |
| 4. | Wedding Chapel<br>Magic Club | | 23,000.00 | 363,000.00 | 386,000.00 | 386,000.00 |
| 5. | Prom Cafe & Lounge<br>Theme | 3,850.00 | | 600,000.00 | 603,850.00 | 603,850.00 |
| 6. | Chelsea Restaurant<br>Theme | 2,000.00 | | 300,000.00 | 302,000.00 | 302,000.00 |
| 7. | Brittania Salon<br>Comedy Club | 4,500.00 | | 990,000.00 | 994,500.00 | |
| 9. | Sun Deck Museum<br>Renovate | | | | 200,000.00 | 200,000.00 |
| 10. | Sir Winston Room<br>Renovate | 4,200.00 | | 200,000.00 | 204,200.00 | 204,200.00 |
| 11. | Prom Deck Retail<br>Add and Renovate | | 60,000.00 | 30,000.00 | 90,000.00 | 90,000.00 |
| | | | | | | |

*Continued Next Page*

| No. | Description | Engr | Structural | Fit-Out | Total 1 | Total 2 |
|---|---|---|---|---|---|---|
| 1. | Observation Lounge<br>Comedy Club | 5,000.00 | | 506,000.00 | | 511,000.00 |
| 7. | Brittania Salon<br>Card Club | 10,000.00 | | 1,080,000.00 | | 1,090,000.00 |
| | | | **TOTAL** | | **4,605,350.00** | **4,735,350.00** |
| | **OPTION-**<br>Enlarge Sir Winston Room | | 75,000.00 | 75,000.00 | | **150,000.00** |

# Volume III
# APPENDIX "A"

*QUEEN MARY*

**VESSEL ANALYSIS**

**SUPPORT MATERIAL**
**FOR**
**HULL and STRUCTURE**
**MACHINERY and PIPING**
**ELECTRICAL**

# *Economics Research Associates STUDY TOTALS*

| *SECTION* | *DESCRIPTION* | *IMMEDIATE* | *DEFERRED* | *TOTAL* |
|---|---|---|---|---|
| I | Summary | 0.00 | 0.00 | 0.00 |
| II | Inrtoduction To Rados Intl corp | 0.00 | 0.00 | 0.00 |
| III | History of Queen Mary | 0.00 | 0.00 | 0.00 |
| IV | Analysis of Sept 26, 1990 Study | 2,095.00 | 1,850.00 | 3,945.00 |
| V | Analysis of Dec 1990 Study | 2,734,425.00 | 288,250.00 | 3,022,675.00 |
| VI | Hull Analysis and Report of Findings | 674,500.00 | 14,766,500.00 | 15,441,000.00 |
| VII | Mechanical and Piping Report of Findings | 1,201,200.00 | 6,055,000.00 | 7,256,200.00 |
| VIII | Electrical Report of Findings | 113,825.00 | 7,575.00 | 121,400.00 |
| | | **$4,726,045.00** | **$21,119,175.00** | **$25,845,220.00** |
| | | | | |
| | | | | |
| IX | Maintenance Costs | Per Year | **4,853,333.00** | **4,853,333.00** |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | *ENLARGE OPTION* | *ALTERNATIVE 1* | *ALTERNATIVE 2* |
| X | Alternative Uses | **$150,000.00** | **$4,809,550.00** | **$4,939,550.00** |

# *HULL and STRUCTURE*

| *No.* | *DESCRIPTION* | *Qty* | *Units* | *Mat'l* | *Labor* | *Total* | *Remarks* |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | **Deck Buckling "A" Deck** | | | | | | |
| 1 | Install Stanchion | | | 1,000 | 1,095 | 2,095 | |
| | | | | | | | |
| | *TOTAL* | | | | | ***$2,095*** | |
| | | | | | | | |
| | **Deck Buckling "C" Deck** | | | | | | |
| 1 | Replace Deck Plating | | | 850 | 1,000 | 1,850 | |
| | | | | | | | |
| | *TOTAL* | | | | | ***$1,850*** | |
| | | | | | | | |
| | **Breasting Structure** | | | | | | |
| 1 | Sandblast and Re-coat | | | | | 4,425 | |
| | | | | | | | |
| | *TOTAL* | | | | | ***$4,425*** | |
| | **Propeller Box** | | | | | | |
| 1 | Clean and Reweld | | | 2,000 | 21,250 | 23,250 | |
| | | | | | | | |
| | *TOTAL* | | | | | ***$23,250*** | |
| | | | | | | | |
| | **Hull Bilges** | | | | | | |
| 1 | ACM Removal | | | | | 780,000 | |
| 2 | Clean, Sandblast and Paint | | | 20,000 | 1,930,000 | 1,950,000 | |
| | | | | | | | |
| | *TOTAL* | | | | | ***$2,730,000*** | |
| | | | | | | | |
| | **Indoor Swimming Pool** | | | | | | |
| 1 | Pool Structural Analysis | | | | | 225,000 | |
| | | | | | | | |
| | *TOTAL* | | | | | ***$225,000*** | |
| | | | | | | | |

# *HULL and STRUCTURE*

| *No.* | *DESCRIPTION* | *Qty* | *Units* | *Mat'l* | *Labor* | *Total* | *Remarks* |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | **Drydocking** | | | | | | |
| 1 | Remove & Reinstall Dyke | | | | | 2,360,000 | |
| 2 | Drydock,Sandblast, Repair & Paint | | | | | 3,900,000 | |
| | | | | | | | |
| | *TOTAL* | | | | | *$6,260,000* | |
| | | | | | | | |
| | **Hull Exterior Above Waterline** | | | | | | |
| 1 | Staging and Paint | | | | | 650,000 | |
| | | | | | | | |
| | *TOTAL* | | | | | *$650,000* | |
| | | | | | | | |
| | **Watertight Bulkheads** | | | | | | |
| 1 | Repair and Replace | | | | | 629,500 | |
| | | | | | | | |
| | *TOTAL* | | | | | *$629,500* | |
| | | | | | | | |
| | **Exterior Decks** | | | | | | |
| 1 | Repair and Refinish | | | | | 710,000 | |
| | | | | | | | |
| | *TOTAL* | | | | | *$710,000* | |
| | | | | | | | |
| | **Exterior Decks** | | | | | | |
| 1 | Remove and Replace | | | | | 2,950,000 | |
| | | | | | | | |
| | *TOTAL* | | | | | *$2,950,000* | |
| | | | | | | | |
| | **Sports Deck Teak Deck** | | | | | | |
| 1 | New Deck | | | | | 1,200,000 | |

# *HULL and STRUCTURE*

| *No.* | *DESCRIPTION* | *Qty* | *Units* | *Mat'l* | *Labor* | *Total* | *Remarks* |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | *TOTAL* | | | | | ***$1,200,000*** | |
| | | | | | | | |
| | **"R" Deck Repair** | | | | | | |
| 1 | Vinyl Tile and Deck | | | | | 25,000 | |
| | *TOTAL* | | | | | ***$25,000*** | |
| | **Expansion Joints** | | | | | | |
| 1 | Clean, Repair and Paint | | | | | 150,000 | |
| | *TOTAL* | | | | | ***$150,000*** | |
| | **Elevator and Escalators** | | | | | | |
| 1 | Repair and Renew | | | | | 1,925,000 | |
| | *TOTAL* | | | | | ***$1,925,000*** | |
| | **Asbestos Containing Material** | | | | | | |
| 1 | Remove and Clean | | | | | 2,000,000 | |
| | *TOTAL* | | | | | ***$2,000,000*** | |
| | **Handicap Accessibility** | | | | | | |
| 1 | Modifications | | | | | 25,000 | |
| | *TOTAL* | | | | | ***$25,000*** | |
| | **Occupant Egress** | | | | | | |

# *HULL and STRUCTURE*

| *No.* | *DESCRIPTION* | *Qty* | *Units* | *Mat'l* | *Labor* | *Total* | *Remarks* |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| 1 | Signage | | | | | 20,000 | |
| | | | | | | | |
| | *TOTAL* | | | | | ***$20,000*** | |
| | | | | | | | |
| | **Pest Control** | | | | | | |
| 1 | Screens | | | | | 8,500 | |
| | *TOTAL* | | | | | ***$8,500*** | |
| | | | | | | | |
| | **Mooring Lines** | | | | | | |
| 1 | Repair and Replace | | | | | 48,000 | |
| | | | | | | | |
| | *TOTAL* | | | | | ***$48,000*** | |
| | | | | | | | |
| | **Life Boats** | | | | | | |
| 1 | Clean Repair and Paint | | | | | 100,000 | |
| | | | | | | | |
| | *TOTAL* | | | | | ***$100,000*** | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | *TOTAL* | | | | | ***$19,587,620*** | |

# *MACHINERY SUMMARY*

| *No.* | *DESCRIPTION* | *Total* | *Remarks* |
|---|---|---|---|
| | | | |
| 1 | Heating Ventilation and Air Conditioning | 726,200 | |
| | | | |
| 2 | Chilled Water System | 208,000 | |
| | | | |
| 3 | Hot and Cold Water System | 202,000 | |
| | | | |
| 4 | Steam System | 150,000 | |
| | | | |
| 5 | Natural Gas System | 5,000 | |
| | | | |
| 6 | Bilge System | 283,000 | |
| | | | |
| 7 | Ballast System | 82,000 | |
| | | | |
| 8 | Deck Drains | 60,000 | |
| | | | |
| 9 | Sewage System | 223,000 | |
| | | | |
| 10 | Firemain and Sprinkling System | 475,000 | |
| | | | |
| 11 | ReplaceFiremain and Sprinkling System | 1,950,000 | |
| | | | |
| 12 | Firemain Detection System | 300,000 | |
| | | | |
| 13 | Public Address System | 150,000 | |
| | | | |
| 14 | Miccelleneous | 200,000 | |
| | | | |
| | *TOTAL* | *$5,014,200* | |

**Machinery Totals**

# *MACHINERY and PIPING*

| *No.* | *DESCRIPTION* | *Qty* | *Units* | *Mat'l* | *Labor* | *Total* | *Remarks* |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | **Heating Ventilation and Air Conditioning** | | | | | | |
| 1 | Replace Air Handlers | 8 | Each | 180,000 | 50,000 | 230,000 | |
| 2 | Repair and Clean Air Handlers | 18 | Each | 10,800 | 56,000 | 66,800 | |
| 3 | Replace Fan Coil Units | 6 | Each | 18,000 | 10,000 | 28,000 | |
| 4 | Repair and Clean Fan Coil Units | 13 | Each | 3,900 | 6,500 | 10,400 | |
| 5 | Replace Supply Fans | 10 | Each | 25,000 | 8,000 | 33,000 | |
| 6 | Repair and Clean Supply Fans | 50 | Each | 10,000 | 25,000 | 35,000 | |
| 7 | Replace Exhaust Fans | 10 | Each | 20,000 | 8,000 | 28,000 | |
| 8 | Repair and Clean Exhaust Fans | 50 | Each | 10,000 | 25,000 | 35,000 | |
| 9 | Replace Coils | 50 | Each | 50,000 | 20,000 | 70,000 | |
| 10 | Duct Cleaning and Misc Repair | 1 | Each | 25,000 | 75,000 | 100,000 | |
| 11 | Material Handling | 1 | Each | 10,000 | 15,000 | 25,000 | |
| 12 | New Fan Coil Units For Hotel Spaces | 18 | Each | 37,000 | 28,000 | 65,000 | |
| | | | | | | | |
| | *TOTAL* | | | | | *$726,200* | |
| | | | | | | | |
| | **Chilled Water System** | | | | | | |
| 1 | Chilled Water Valves | 200 | Each | 20,000 | 40,000 | 60,000 | |
| 2 | Chilled Water Piping and Fittings | 500 | Feet | 25,000 | 50,000 | 75,000 | |
| 3 | Chilled water Insulation | 500 | Feet | 1,000 | 3,000 | 4,000 | |
| 4 | C/W & Steam for New Fan Coil Units | 18 | Each | 18,000 | 36,000 | 54,000 | |
| 5 | Umbilical | 2 | Each | 5,000 | 10,000 | 15,000 | |
| | | | | | | | |
| | *TOTAL* | | | | | *$208,000* | |
| | | | | | | | |
| | **Hot and Cold Water System** | | | | | | |
| 1 | Valves | 200 | Each | 25,000 | 52,000 | 77,000 | |
| 2 | Piping | 2000 | Feet | 25,000 | 60,000 | 85,000 | |
| 3 | Insulation | 2000 | Lin Ft | 10,000 | 30,000 | 40,000 | |
| | | | | | | | |
| | *TOTAL* | | | | | *$202,000* | |

# *MACHINERY and PIPING*

| *No.* | *DESCRIPTION* | *Qty* | *Units* | *Mat'l* | *Labor* | *Total* | *Remarks* |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | | | | | | | |
| | **Steam System** | | | | | | |
| 1 | Valves | 300 | Each | 20,000 | 40,000 | 60,000 | |
| 2 | Piping | 1000 | Feet | 15,000 | 50,000 | 65,000 | |
| 3 | Insulation | 1000 | Lin Ft | 5,000 | 10,000 | 15,000 | |
| 4 | Umbilical | 2 | Each | 5,000 | 5,000 | 10,000 | |
| | | | | | | | |
| | *TOTAL* | | | | | *$150,000* | |
| | | | | | | | |
| | **Natural Gas System** | | | | | | |
| 1 | Inspect and Repair | 1 | Sys. | 1,000 | 4,000 | 5,000 | |
| | | | | | | | |
| | *TOTAL* | | | | | *$5,000* | |
| | | | | | | | |
| | **Bilge System** | | | | | | |
| 1 | Pumps | 3 | Each | 15,000 | 25,000 | 40,000 | |
| 2 | Piping | - | Each | 70,000 | 100,000 | 170,000 | |
| 3 | Valves | 15 | Each | 30,000 | 43,000 | 73,000 | |
| | | | | | | | |
| | *TOTAL* | | | | | *$283,000* | |
| | | | | | | | |
| | **Ballast System** | | | | | | |
| 1 | Valves | 7 | Each | 21,000 | 30,000 | 51,000 | |
| 2 | Piping | - | Feet | 6,000 | 25,000 | 31,000 | |
| | | | | | | | |
| | *TOTAL* | | | | | *$82,000* | |
| | | | | | | | |
| | **Deck Drains** | | | | | | |
| 1 | Clean | 200 | Each | 5,000 | 30,000 | 35,000 | |
| 2 | Strainer Plates | 200 | Each | 10,000 | 15,000 | 25,000 | |
| | | | | | | | |

# *MACHINERY and PIPING*

| *No.* | *DESCRIPTION* | *Qty* | *Units* | *Mat'l* | *Labor* | *Total* | *Remarks* |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | *TOTAL* | | | | | *$60,000* | |
| | | | | | | | |
| | **Sewage System** | | | | | | |
| 1 | Overhaul Sewage Pumps | 6 | Each | 8,000 | 10,000 | 18,000 | |
| 2 | Valves Overhaul/Replace | 50 | Each | 30,000 | 60,000 | 90,000 | |
| 3 | Piping | 500 | Lin Ft | 35,000 | 80,000 | 115,000 | |
| | | | | | | | |
| | *TOTAL* | | | | | *$223,000* | |
| | | | | | | | |
| | **Firemain and Sprinkling System** | | | | | | |
| 1 | Firemain and Sprinkling | 1 | Sys. | 100,000 | 375,000 | 475,000 | |
| | | | | | | | |
| | *TOTAL* | | | | | *$475,000* | |
| | | | | | | | |
| | **Replace Firemain and Sprinkling System** | | | | | | |
| 1 | Firemain and Sprinkling Replace | 1 | Sys. | 600,000 | 1,350,000 | 1,950,000 | |
| | | | | | | | |
| | *TOTAL* | | | | | *$1,950,000* | |
| | | | | | | | |
| | **Fire Detection System** | | | | | | |
| 1 | Console and detectors | 1 | Sys. | | | 300,000 | |
| | | | | | | | |
| | *TOTAL* | | | | | *$300,000* | |
| | | | | | | | |
| | **Public Address System** | | | | | | |
| 1 | Console and periphails | 1 | Sys. | | | 150,000 | |
| | | | | | | | |
| | *TOTAL* | | | | | *$150,000* | |
| | | | | | | | |
| | **Miscellaneous** | | | | | | |

# *MACHINERY and PIPING*

| *No.* | *DESCRIPTION* | *Qty* | *Units* | *Mat'l* | *Labor* | *Total* | *Remarks* |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| 1 | | 1 | | 75,000 | 125,000 | 200,000 | |
| | | | | | | | |
| | *TOTAL* | | | | | *$200,000* | |

# *ELECTRICAL SUMMARY*

| *No.* | *DESCRIPTION* | *Total* | *Remarks* |
|---|---|---|---|
| | | | |
| 1 | **Substation and Connected Auxiliaries** | 98,825 | |
| | | | |
| 2 | **Second Electrical Room Exits** | 7,575 | |
| | | | |
| 3 | **Emergency Generator Repair and Service** | 15,000 | |
| | | | |
| | | | |
| | *TOTAL* | ***$121,400*** | |
| | | | |
| | | | |
| | | | |
| | | | |

**Electrical Totals**

# *ELECTRICAL*

| *No.* | *DESCRIPTION* | *Qty* | *Units* | *Mat'l* | *Labor* | *Total* | *Remarks* |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | **Substation and Connected Auxiliaries** | | | | | | |
| 1 | Substation No.1 C.B. 600AF | 1 | Each | 2,700 | 225 | 2,925 | |
| 2 | Substation No.1 General | 1 | Each | 150 | 100 | 250 | |
| 3 | Substation No.2 C.B. 800AF | 1 | Each | 2,700 | 225 | 2,925 | |
| 4 | Substation No.2 General | 1 | Each | 150 | 600 | 750 | |
| 5 | Substation No.3 C.B. 1200AF | 1 | Each | 4,500 | 225 | 4,725 | |
| 6 | Substation No.3 General | 1 | Each | 150 | 400 | 550 | |
| 7 | Substation No.4 C.B. 1000AF | 1 | Each | 4,500 | 225 | 4,725 | |
| 8 | Substation No.4 General | 1 | Each | 50 | 100 | 150 | |
| 9 | Substation No.5 C.B. 1200AF | 1 | Each | 4,500 | 225 | 4,725 | |
| 10 | Substation No.5 General | 1 | Each | 2,400 | 3,800 | 6,200 | |
| 11 | Substation No.6 C.B. 1000AF | 1 | Each | 4,500 | 225 | 4,725 | |
| 12 | Substation No.6 General | 1 | Each | 1,400 | 1,700 | 3,100 | |
| 13 | Substation No.7 C.B. 1200AF | 1 | Each | 4,500 | 225 | 4,725 | |
| 14 | Substation No.7 General | 1 | Each | 1,100 | 4,100 | 5,200 | |
| 15 | Substation No.8 C.B. 1600AF | 1 | Each | 4,500 | 225 | 4,725 | |
| 16 | Substation No.8 General | 1 | Each | 600 | 2,400 | 3,000 | |
| 17 | Substation No.9 C.B. 1600AF | 1 | Each | 4,500 | 225 | 4,725 | |
| 18 | Substation No.9 General | 1 | Each | 1,400 | 5,000 | 6,400 | |
| 19 | Substation No.10 C.B. 1000AF | 1 | Each | 4,500 | 225 | 4,725 | |
| 20 | Substation No.10 General | 1 | Each | 500 | 2,200 | 2,700 | |
| 21 | Substation No.11 C.B. 1600AF | 1 | Each | 4,500 | 225 | 4,725 | |
| 22 | Substation No.11 General | 1 | Each | 900 | 800 | 1,700 | |
| 23 | Substation No.12 C.B. 1600AF | 1 | Each | 4,500 | 225 | 4,725 | |
| 24 | Substation No.12 General | 1 | Each | 1,400 | 5,800 | 7,200 | |
| 25 | Substation No.13 C.B. 1600AF | 1 | Each | 4,500 | 225 | 4,725 | |
| 26 | Substation No.13 General | 1 | Each | 800 | 3,000 | 3,800 | |
| | | | | 65,900 | 32,925 | | |
| | *TOTAL* | | | | | *$98,825* | |
| | | | | | | | |

# *ELECTRICAL*

| *No.* | *DESCRIPTION* | *Qty* | *Units* | *Mat'l* | *Labor* | *Total* | *Remarks* |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | **Exits** | | | | | | |
| 1 | Second Electrical Room Exit | 13 | Each | 3,575 | 4,000 | 7,575 | |
| | | | | | | | |
| | *TOTAL* | | | | | *$7,575* | |
| | | | | | | | |
| | | | | | | | |
| | **Emergency Generator** | | | | | | |
| 1 | Service, Check-Out and Repair | 1 | Each | 5,000 | 10,000 | 15,000 | |
| | | | | | | | |
| | *TOTAL* | | | | | *$15,000* | |
| | | | | | | | |
| | | | | | | | |

# *ALTERNATIVE USES STUDY*

| | ALTERNATIVE 1 | | ALTERNATIVE 2 | |
|---|---|---|---|---|
| | | | | |
| OBSERVATION LOUNGE | MUSIC CLUB | 464,500 | COMEDY CLUB | 511,000 |
| QUEEN'S LOUNGE | DINNER THEATER | 482,000 | DINNER THEATER | 482,000 |
| ROYAL SALON | SPORTS BAR | 525,000 | SPORTS BAR | 520,000 |
| WEDDING CHAPEL | MAGIC CLUB | 386,000 | MAGIC CLUB | 381,000 |
| PROM CAFE AND LOUNGE | RESTAURANT | 603,850 | RESTAURANT | 603,850 |
| CHELSEA RESTAURANT | RESTAURANT | 302,000 | RESTAURANT | 300,000 |
| BRITTANIA SALON | COMEDY CLUB | 994,500 | CARD CLUB | 1,090,000 |
| VERANDA GRILL | MUSIC AND DANCE CLUB | 402,500 | MUSIC AND DANCE CLUB | 402,500 |
| SUN DECK MUSEUM | MUSEUM, RENOVATE | 200,000 | MUSEUM, RENOVATE | 200,000 |
| SIR WINSTON ROOM | RESTAURANT | 155,000 | RESTAURANT | 155,000 |
| PROM DK RETAIL SHOPS | RETAIL, RENOVATE | 90,000 | RETAIL, RENOVATE | 90,000 |
| ENLARGE, OPTION | SIR WINSTON ROOM | 150,000 | SIR WINSTON ROOM | 150,000 |
| | | | | |
| | | | | |
| | WITH ENLARGE | **4,755,350** | | **4,885,350** |
| | W/O ENLARGE | **4,605,350** | | **4,735,350** |

# *ELECTRICAL MAINTENANCE*

| *No.* | *DESCRIPTION* | *Qty* | *Mat'l* | *Labor* | *Total* | *Remarks* |
|---|---|---|---|---|---|---|
| | | | | | | |
| | **Maintenance Requirements** | | | | | |
| 1 | C/B Clean, Inspect, Test, and Torque | 13 | 1,450 | 2,925 | 4,375 | |
| 2 | Test Motor Overloads | 20 | 1,850 | 3,000 | 4,850 | |
| 3 | Test GF System | 100 | 7,050 | 15,000 | 22,050 | |
| 4 | Test Insulation (Doble) | 13 | 2,900 | 3,900 | 6,800 | |
| 5 | Test Grounding System | 13 | 2,850 | 5,550 | 8,400 | |
| 6 | Megger Cables | 100 | 3,750 | 7,500 | 11,250 | |
| | | | | | | |
| | *TOTAL* | | | | *$57,725* | |
| | | | | | | |
| | | | | | | |
| | **Emergency Generator Test** | | | | | |
| 1 | Start, Load Test (2Hrs) | 1 | 150 | 300 | 450 | |
| | | | | | | |
| | *TOTAL* | | | | *$450* | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

# Volume III
# APPENDIX "B"

*QUEEN MARY*

**VESSEL ANALYSIS**

**SOURCE**
**AND**
**REFERENCES**

# APPENDIX "B"

The following list represents publications and articles used in the preparation of this report.


ANSI A159.1-1972 Surface preparation specifications
Steel structures painting council

CORPRP Companies, Inc.
Corrosion investigation of the Hotel Queen Mary dated
26 November 1989

NEC - National Electric Code

NFPA - National Fire Protection Association

OSHA - Occupational Safety and Health Administration

Port of Long Beach
Exterior and Interior Hull Investigation Report
dated 16 October 1991

UBC - Unified Building Codes


In addition to the above publications and articles information on specific items were obtained from the following sources:


Entertainment Cost Consultant - David Holtz

ERA - Economics Research Associates

Disney Company

# Volume III
# APPENDIX "C"

*QUEEN MARY*

**VESSEL ANALYSIS**

**DOCUMENT CONTROL**

# APPENDIX "C"

## Document Control

The drawings aboard the vessel totaling a few thousand, include the original builders drawings and subsequent conversion and modification drawings. These drawings are spread throughout the ship with two major areas of storage. The primary storage areas ("A" Deck fwd & "F" Deck aft) are incomplete disarray and each time a drawing is needed, hours or days of searching is required.

The following is offered for the information and consideration of the reader and not listed as a work item or option. But for an item as important as ships drawings, we feel that someone should investigate the possibilities listed below.

To organize the drawings aboard the vessel, one large area should be selected and all drawings delivered to that area, a search throughout the vessel to collect all drawings not delivered to that area

Drawings are to be separated and cataloged using a computer to track each drawing. After all drawings are cataloged and the computer has sorted to some intelligent order, the drawing will be indexed and stored in that sorted order. Drawings not found should be documented.

A single space aboard the vessel should be selected to house the stored drawings with someone in charge of document control. The computer should be used to track the subsequent use of all drawings.

It may be worthwhile having an inexpensive Ozalid blueprinting machine in the area. This would allow someone to take a print of the drawing instead of the original.

The following database fields may represent the minimum information required on each drawing

1. Index No.
2. Drawing No.
3. Drawing Title
4. Original/Print
5. Building/Conversion/Modification
6. Drawing Revision
7. In File/Checked Out
8. Checked Out By:
9. File Location

Search any field to find drawing
Maybe color coded sets for quick ident,
i.e., Blue - builders dwgs
Green - Conversion dwgs
White - Modification dwgs

Amount $ <u>100,000.00</u>