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FLORIDA INTERNATIONAL UNIVERSITY

Miami, Florida

CRUISE SHIP PORT PLANNING FACTORS

A dissertation submitted in partial fulfillment

of the requirements for the degree of

DOCTOR OF PHILOSOPHY

in

CIVIL ENGINEERING

by

Jeth Al Fogg

2001

To: Interim Dean Richard Irey
College of Engineering

This dissertation, written by Jeth Al Fogg, and entitled Cruise Ship Port Planning Factors, having been approved in respect to style and intellectual content, is referred to you for judgment.

We have read this dissertation and recommend that it be approved.

L. David Shen

Irtishad U. Ahmad

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Luis Ajamil

Luis Prieto-Portar, Major Professor

Date of Defense: April 2, 2001

The dissertation of Jeth Al Fogg is approved.

Interim Dean Richard Irey
College of Engineering

Interim Dean Samuel S. Shapiro
Division of Graduate Studies

Florida International University, 2001

DEDICATION

I dedicate this dissertation to my beautiful bride Margaret and my adorable daughter Taylor. Without their patience, understanding, support and most of all love, the completion of this work would not have been possible.

ACKNOWLEDGMENTS

I wish to thank the members of my committee for their support, patience, and good humor. Their gentle but firm direction has been most appreciated. Irtishad Ahmad has been a guiding light ensuring that I met all the curriculum requirements throughout my tenure at Florida International University (FIU). I appreciate the encouraging nature of Nestor Gomez who particularly liked the interview style associated with collecting the necessary information gathered within these pages as opposed to the traditional "prove it in a laboratory technique" associated with most doctoral engineering programs. I am thankful for Luis Ajamil who has been a wealth of information pertaining to all aspects of the cruise ship industry and very helpful in directing me to the right sources for collecting my raw data. I am particularly thankful to L. David Shen for giving me the opportunity to contribute to the Department in several courses, further honing my teaching skills while completing my doctoral degree at FIU. And lastly, I'm most grateful to Luis Prieto-Portar who was particularly helpful in guiding me toward this topic and helping me to achieve my goals. He has been instrumental in taking me from the level of an instructor to that of a professor. With his guidance I not only completed a Doctoral degree, but I also learned the practical skills needed to lead teams of talented individuals to accomplish research on multifaceted topics. His lessons will serve me well in the future regardless of my career path in academia, the military or the private sector.

ABSTRACT OF THE DISSERTATION

CRUISE SHIP PORT PLANNING FACTORS

by

Jeth Al Fogg

Florida International University, 2001

Miami, Florida

Professor Luis A. Prieto-Portar, Major Professor

The predictions contained within this dissertation suggest further rapid growth of the cruise industry and the requirement for additional cruise ship berthing worldwide. The factors leading to the tremendous growth in the cruise marketplace are identified and individually addressed. Unfortunately, planning factors associated with the design and construction of cruise ship seaports are not readily available and methods to manage this growth have not been addressed. This dissertation provides accurate and consolidated planning factors essential for comprehensive consideration of cruise ship requirements and design of growing cruise ship ports. The consolidation of these factors results in faster and better informed choices for the port owner/operator with regard to port expansion. Furthermore, this dissertation proposes development of new systems to better manage increasing passenger and ship traffic. If implemented, this will result in optimized port systems providing a greater level of service to passengers and port authorities while simultaneously minimizing environmental and economic impact.

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LIST OF ACRONYMS

APHIS – Animal and Plant Health Inspection Service

EMS – Emergency Medical Services

FIS – Federal Inspection Station

FWS – Fish and Wildlife Service

HVAC – Heating Ventilation and Air Conditioning

IATA – International Air Transportation Association

INS – Immigration and Naturalization Service

MIA – Miami International Airport

PHS – Public Health Service

PVSA – Passenger Vessel Services Act

RT –Round Trip

SCUBA – Self Contained Underwater Breathing Apparatus

TECS – Treasury Enforcement Communication System

USCG – United States Coast Guard

USCS – United States Customs Service

USEPA – United States Environmental Protection Agency

EXECUTIVE SUMMARY

The cruise ship industry started off like a healthy plant in a small pot. When it was small, it struggled, survived and flourished in the small pot. But after a thriving youth, the pot became restrictive and the plant is starting to get root bound. Is it time to repot the plant and allow it to grow and be productive, or do nothing and let it slowly suffocate itself?

The cruise industry is getting root bound and becoming constrained by existing port operation conditions. Furthermore, the situation will be exacerbated when market demand spikes in the near future. This dissertation examines cruise ship port planning issues, and demonstrates that the market demand will continue to increase in the future. This increase in demand will be driven by the factors listed below.

1. The potential repeal of the Passenger Vessel Services Act (PVSA).
2. The retirement of ships from the U.S. market to the Pacific Rim market.
3. The shift in cargo operations.
4. The continuing increase in cargo volume.
5. Expansion of cruise lines and their growth rate.
6. The aging baby boomer generation within the U.S. and the ensuing increase associated with leisure time demands.
7. The perceived value of cruise vacations versus traditional land-based vacations.

Each of these factors will contribute to significant growth in the world-wide cruise ship market. In the following paragraphs, the individual impact of each factor listed above is further explained.

(1) Arizona Senator John McCain has sponsored legislation to repeal the Passenger Vessel Services Act (PVSA) (McCain, J. 107th Congress) during recent congressional sessions, but his efforts thus far have been thwarted. However, with his increased popularity, the current political leadership in the White House, and the marginal control of the House of Representatives and the Senate held by the Republican party, his legislation has the possibility of passing through both houses and becoming law. The legislation, entitled, The United States Cruise Vessel Act is best described as "A bill to give American companies, American workers and American ports the opportunity to compete in the United States cruise market" When this happens, the cruise scene within the United States will change dramatically. How does this affect the cruise lines? Currently, the PVSA prevents foreign flagged and/or crewed ships from making consecutive stops at ports of call with the United States. When the PVSA is repealed, United States port cities will instantly become tourist destinations. These ports not only become destinations, but they may also become origination ports. The opportunity to develop cruises destinations throughout the east and west coasts becomes a viable option, and this further opens up markets in the Hawaiian Islands, The Great Lakes and other navigable inland waterways.

(2) Another significant factor is the retirement of ships currently operating from the U.S. market to the Pacific Rim market. These tend to be older ships that are still serviceable, but no longer meet the safety standards required to operate from U.S. ports.

Once retired, these ships are typically refitted and put into service in the Pacific Rim marketplace. In the future, the number of retired ships relocating with new cruise lines to the Pacific Rim will continue to grow. A quick look at Pacific region maps highlights numerous cruise destination and possible origination ports. Some countries, with significant transportation and tourism infrastructure such as Singapore have already recognized this. But even still, the cruises currently offered in the Pacific are few indeed, due to the large travel distances from the United States and Europe and since the vast majority of current cruise travelers are from the United States or Europe. To fully develop the Pacific Rim cruise market, passengers must be sought out within that market itself. The Pacific Rim marketplace will grow, but its growth may be relatively slow and heavily dependent on the Pacific Rim economy. As the Pacific Rim economy restabilizes, and disposable incomes become more readily available, growth can be expected in that marketplace.

(3) The recent shift in investment from developing new cargo ports, to maximizing the cargo throughput of existing ports, is another clear indicator of the seaport trend. The expansion of port facilities is a heavy economic burden for many communities to swallow. With significant interest in ecological responsibility, to ensure a future for the children of today, communities are seeing the value of natural tidal areas and their contribution to cleaning up waterways and ensuring a viable future for threatened species. This translates into an opposition to new berthing locations, which, using the technology of yesterday, limits port capacity. Using new technology and analyzing the entire cargo process has refocused the development of cargo areas. Because of environmental concerns, the easier sell is for better management of existing port assets. This includes

optimization of crane operations, cargo inspection and the entire intramodal process moving cargo to and from the port area, while minimizing cargo storage time at the port.

Figure ES.1 Cargo Operations

All this contributes to the ultimate goal of minimizing ship time at the berth and maximizing the berth turnover rate. Due to the direct revenue generated by cargo, and the diversity of cargo ports around the world, cargo operations are recognized as the trend-setter for transportation in maritime operations. Similar accommodations must be made for cruise lines to enhance their port throughput and maximize berth turnover rate, much like the cargo lines.

(4) The continuing increase in cargo volume is closely related to the enhancement of throughput, with one small exception. The enhancement of throughput is primarily for environmental reasons, whereas the continuing increase in cargo volume is due to

growing worldwide consumerism, further expansion of the global marketplace and quite simply the continuous growth of the world population. These three issues have led to increased use of port facilities and demand for berthing locations. The competition for the berthing locations will continue to directly impact the cruise lines. Both cruise and cargo ships compete for these same berths in multi-use facilities, or for the berthing space and adjacent land area for dedicated cruise and/or cargo operations.

(5) Cargo operations are not the only area of maritime operation experiencing tremendous growth. The cruise lines continue to expand at a rate of almost 10% annually in the U.S. This phenomenal growth is in spite of the fact that 76% of the target market

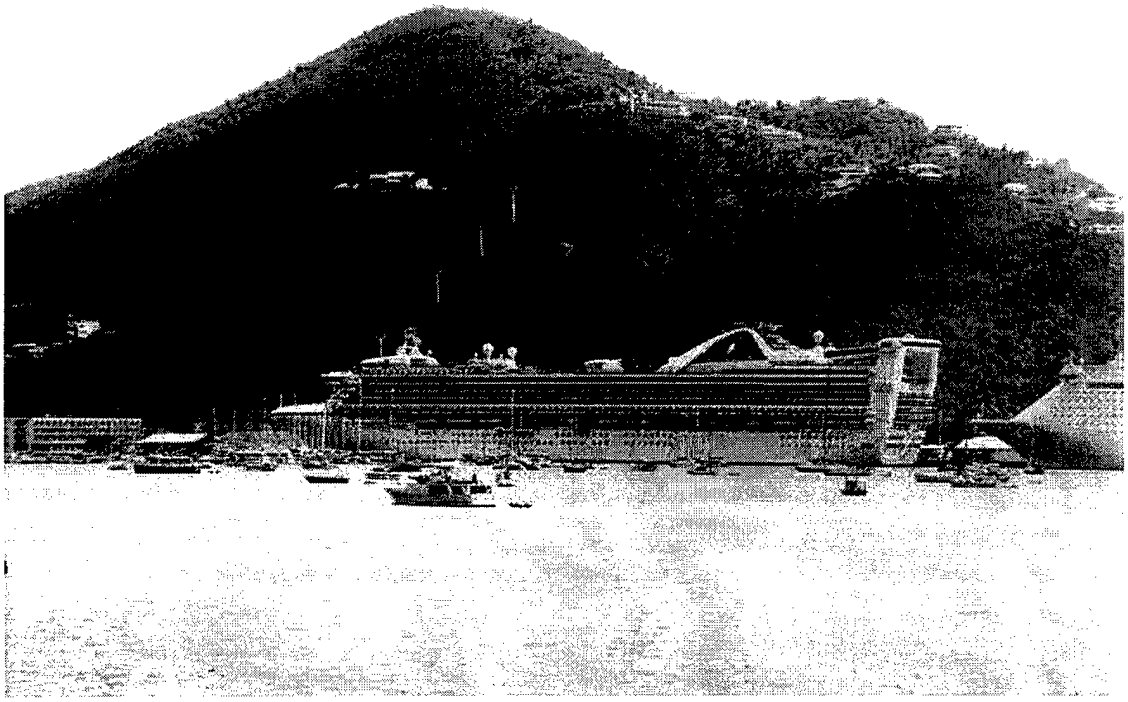


Figure ES.2 Mega Ship, Grand Princess at Berth in St. Thomas

has never taken a cruise before. Of that 76%, 49% have never cruised, but are likely to take a cruise and the remaining 27% are non-vacationers ("Cruise Industry Overview",

CLIA). The cruise lines have adjusted to this growth by expanding into new markets and utilizing larger ship designs. But the expansion is still concentrated in the Caribbean market and four ports (Miami, Port Canaveral, Port Everglades and San Juan) accommodate a majority of the worldwide cruise ship traffic. This is primarily due to the readily available cruise destination ports and the year round capability of these ports to comfortably accommodate passengers in a warm tropical/subtropical climate. For the time being, the introduction of mega-ships accommodating 3000 passengers has alleviated congestion at the origination ports. This introduction has not come without problems. These new ships can't berth in all ports due to their size, and that results in tender operations to ferry the passengers into the port from the ship. It can even mean cancelled ports of call if the weather is too rough to accommodate the tender operations. In the future a happy median must be met where the ships are small enough to utilize port facilities, but large enough to be economically profitable for the cruise lines.

(6) Another factor looming on the horizon is the post World War II baby boomer generation within the United States. Currently, 53% of cruise passengers within the last five years are baby boomers with an average age of 50 years old. ("Cruise Industry Overview", CLIA) As the baby boomer generation gets older, they will retire and look to travel as an important component of their leisure. Given the perceived value of cruise travel, and the variety of destinations that can be sought out worldwide, this will result in another surge in cruise popularity and the resulting port demand.

(7) The perceived value of cruise vacations versus other traditional vacations has had a significant impact on the number of families trying cruise vacations. In relative terms, a cruise vacation is a great deal. The typical vacation requires travel to the destination by

either land or air. Once at the destination, food, lodging, entertainment and local transportation expenses must be paid. The cruise passenger has a similar situation. Cruise ship passengers have the initial expense of travel, but all the remaining items, lodging, food, entertainment and transportation are rolled into the price of the cruise. When a land-based vacation is compared head to head with a cruise vacation for a mid-range vacation, the land-based vacation averages $263 per day whereas, the cruise vacation averages $252 per day. Furthermore, the cruise passenger has the advantage of visiting a variety of locations, sampling the best each port city/location has to offer. This can further add to the value of the cruise. Another new phenomena is using cruises as the venue for business seminars and conferences. One typical problem with land-based conferences is the decreasing participation as the conference progresses. If a conference is held on a cruise ship, the audience is "captive" and escaping toward non-conference activities is more difficult. It is recommended that conference activities occur mostly while "at sea" and not at the destination ports, and thus strike the balance of business and pleasure.

In summary, cruise ship ports have been around for many years and the industry has flourished and expanded within existing ports. The graph below shows the growth trend in the cruise industry thus far and projections for the future. Now the ports, environmental regulation and public opinion are becoming restrictive and the industry is starting to get root bound. The situation will be exacerbated as market demand continues to grow. The demand prediction is supported by the several factors discussed previously. Now the demand must be met. The question is how? Consolidation of cruise ship port planning factors is a helpful step in the right direction. But this type of dramatic growth

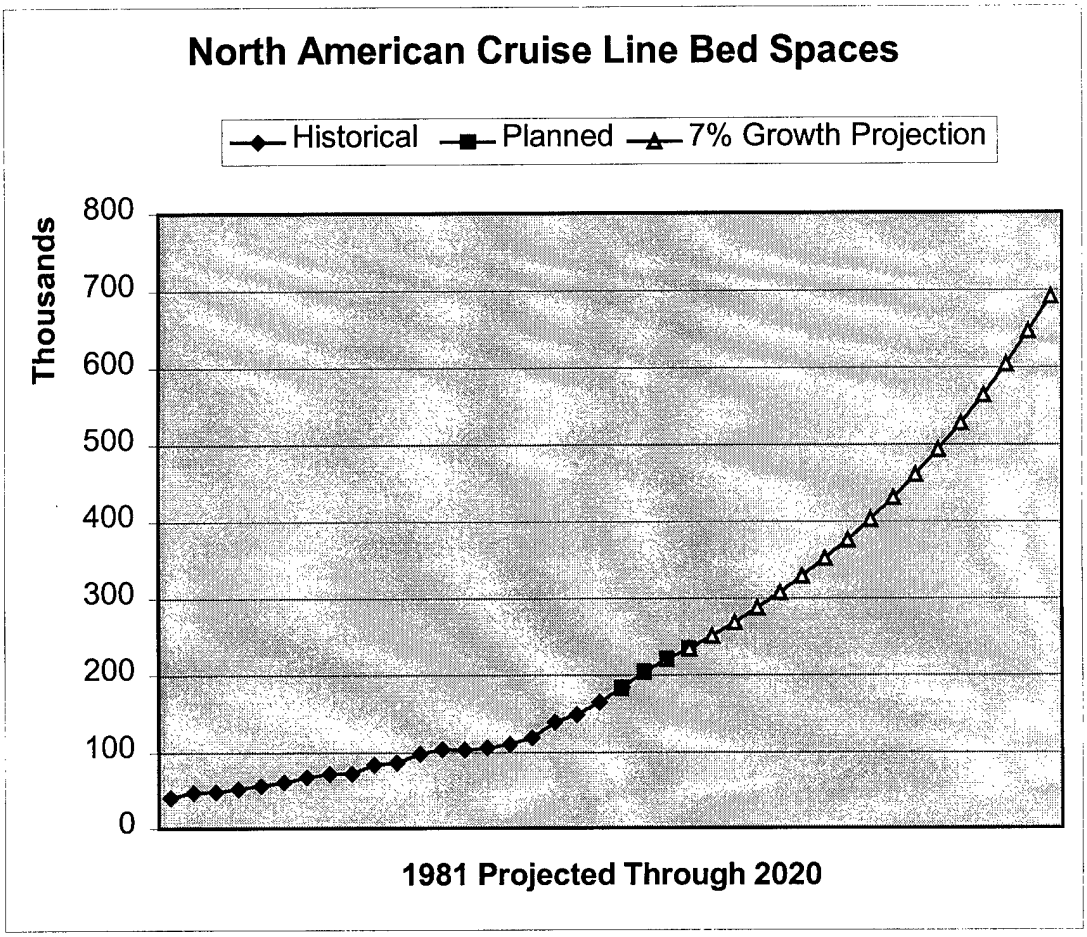


Figure ES.3 Cruise Line Passenger Growth Projection

will require a dramatic solution. The solution is the Centralized Cruise Finger Terminal Concept outlined in this dissertation. This expandable concept will allow cruise lines and ports to handle increased cruise demands in an efficient, environmentally friendly and low cost manner at high traffic ports. Now it is a question for port operators: will they repot the plant and allow it to grow and be productive, or do nothing, and let it wither and die?

CHAPTER I

INTRODUCTION

This introduction provides several key pieces of information, starting off with the problem statement for this dissertation. This is followed by the overall scope of the dissertation. Critical to grasping the entire cruise port concept is understanding the differences between cruise and cargo ports, which are outlined in the background information. With background information understood, the objectives of the dissertation are stated, followed by the expected results and the organization of the dissertation.

(a.) Problem Statement

As mentioned in the Executive Summary, numerous factors will contribute to continued rapid growth in the cruise industry. In an effort to better manage cruise port growth, this dissertation is devoted to consolidating planning factors associated with the design and construction of seaports for the cruise ship industry.

(b.) Dissertation Scope

The scope of this dissertation is limited to the intermodal operations associated with the loading and unloading of passengers and supplies on and off cruise ships while they are visiting origination and destination cruise ports.

(c.) Background Information on Sea Ports

Before covering the specifics of this research, a better understanding of cargo and cruise seaports is required. This is best accomplished by highlighting the varying requirements of cargo and cruise ships. The operational premise of cruise ships varies significantly from cargo ships. Basically, cargo ships are geared to transport material

from one point to another. Manufacturing, consumerism, and transferring goods to other modes of transportation are the factors determining the viability of cargo ship ports. Designing an economically viable cruise ship port requires some of these planning factors in addition to several others.

Cruise ship ports can be divided into two types, homeports and destination ports. The homeport of a cruise ship is also called the origination port and these ports have significant requirements geared around geographic location relative to the cruise market, air and land transportation, ship maintenance, ship re-supply, lodging and tourism. The second type is a destination port, which must be within a 3 to 7 day sailing "window" from an origination port. These ports are visited by cruise ships and focus heavily on tourism and transportation of passengers from the ship to tourist activities. The tourism value of a location is a culmination of activities such as shopping, water sports, eco-tourism, historical sites, providing a venue for specialty conferences, and/or relaxing on the beach.

In addition to the types of ports visited, cargo and cruise ships have some other varying requirements. The material transported on a cargo ship doesn't care about scenic beauty, waiting in confined spaces for long durations of time to exit the ship, or how it is trans-shipped or transported to its final destination. By contrast, the passengers on a cruise ship pay to visit the ports of call with scenic locations. The scenery is a prime motivator for passengers making return voyages to the same port of call. Additionally, the means, ease of access, personal and material security, and time required to transport the passengers from the ship (waterside) to the port attractions (landside) are crucial. More delays and inconvenience mean less time to visit the port of call. These are

significant factors impacting the passenger's desire to make return visits to a particular port of call or to recommend it to other travelers. Furthermore, this has an impact on the likelihood of conducting business with the cruise ship line in the future. Fortunately, the cruise line and port authority can make improvements to facilities to ensure repeat visitors and attract new visitors which both translate into revenue. Basically, passengers want to visit aesthetically pleasing places in a safe and comfortable manner with minimal delays and maximum time to enjoy the port of call. The difference in how cargo is handled versus how passengers are handled falls within the primary focus of this research.

Currently, the cruise ship port planning process is broken down into four steps that go well beyond the scope of this research. But for the sake of background information, and to give a better understanding of the intricacies of the entire process, the four-step process is summarized in the following paragraphs. They are (1) market analysis, (2) examination of existing port conditions, (3) port development options, and lastly (4) financial analysis and plan implementation. Each one of these steps has an overall objective highlighted as each is examined closer.

(1) Market Analysis: First, a market analysis must be conducted. To determine the number of cruise ship berths (parking spaces) the port will require to support cruise ship operations. The market analysis examines both cruise and cargo operations. For the cruise operation a short- and long-range market demand is made which includes global and regional cruise markets, cruise ship industry characteristics, and existing cruise operations at the port of interest. After the market demand is established, attributes of the port of interest as a port of call and as a homeport are assessed. This includes geographic

sustainability as well as adequate local facilities to support cruise ship activity. After the market demand and the port attributes are assessed, a projection of cruise traffic for the port of interest is made. From this projection, the economic benefits due to port charges for cruise operations and the economic benefits to adjacent municipalities due to expanded cruise operations are examined. After examining the cruise operations, the cargo operations must be considered as part of the overall port development plan. The cargo operations undergo a similar short- and long-range market demand, which includes characteristics of global and regional cargo operations and assessment as a potential site for trans-shipment operations. After the market demand, a projection of cargo expansion with forecasts of future cargo throughput and facilities forecast for expanded cargo operations is completed.

(2) Existing Port Conditions: The existing port conditions are evaluated to see if the port can support the market analysis recommendations. This should be considered from a physical facility and administrative perspective. The objective of the existing port condition evaluation is to determine if the berthing resources at the port are large enough to support anticipated cruise and cargo ship activity. Additionally, the managerial system and financial independence of the port should also be considered.

On the physical side, the study points out underutilized areas and/or areas requiring further enhancement, which may include the addition of berthing space. To conduct a thorough examination of existing port conditions, the port in question and adjacent ports serving the same area must be examined. For the port in question, examine the location and urban context to include the regional setting, surrounding functional areas, view corridors and gateways, proposed projects and public

improvements. After a picture of the area adjacent to the port is established, the existing conditions of the port are evaluated. Examination includes the port's internal functional areas, ship berthing, channel access, dockside passenger facilities and accommodations, vehicular access, container cargo facility, yard and structural conditions. Similarly, the administrative system and financial independence of the port should be examined. Determine if the port is owned as a public corporate entity or as a public agency reporting through some local governing authority. Who makes long-range decisions with regard to the future of the port? Does the port retain profits for reinvestment, or are the profits siphoned off to other public agencies and/or activities. Now that a complete picture of the current port is developed, identify the opportunities and constraints associated with the port. This identifies any shortcomings that must be overcome and strengths that can be capitalized on. Examine adjacent port(s) serving the same location, in a similar manner. Consider the combined impact of these ports with the possibility of specializing each port to specific types of cargo and or cruise traffic. The goal is to maximize resources, and combining the resources of adjacent ports may have a significant impact on the overall ability of a municipality to handle ship traffic.

(3) Port Development Options: This is where the "engineering" is perceived to begin. The objective of the port development options is to develop several different plans enhancing existing port conditions to a level supporting the market analysis. In other words, how and where can new berths be added or can similar operations be relocated and/or consolidated to meet future demands. The port development options are driven by a culmination of information developed from the analysis of marketing trends, financial benefits and existing facilities evaluation. What results is a baseline from which to

develop port development alternatives. These alternatives take into consideration different uses of land, dredging and/or filling basins, berthing locations and configuration, as well as new construction and/or extension of piers and quays. After evaluation of each option, a port development option based on available funding and/or cost benefit ratio is selected, and it can be turned into a final master plan. The final master plan contains the long-range vision of what the port aspires to resemble after, say 20 years of development. To reach that point, several different phases of port development may be required. They are best described as immediate (1-2 years), short-range (2-5 years), long-range (5-15 years), and the overall vision reached at the 20-year mark. Plans are not developed in overwhelming detail due to the changing nature of goals. For example, the immediate plans would have significant detail whereas the long-range plan would be much more conceptual. Development plans are broken down into stages with economic summaries for each stage. Similar evaluation should be accomplished for other ports serving the same municipality. This is accomplished to best utilize the resources available, recognizing that some ports may be more advantageous for container and/or bulk cargo use, while others lend themselves to cruise ship operations.

(4) Financial Analysis and Plan Implementation: Once the first steps have been studied, a methodology to pay for the port development options must be assessed. The objective of the financial analysis and plan implementation is to determine the best way to finance the proposed enhancements and a timeline to implement them that is feasible both economically and practically. This is initiated with a history of the past financial situation leading to a current assessment of finances. Issues to consider are the tariff

structure and its impact on the port. When taking the tariffs into consideration, a set of scenarios with different tariffs should be evaluated. For example, unadjusted tariffs, tariffs with adjustment for inflation and with market driven adjustment should all be considered as possible scenarios. Once the tariff scenarios are developed, this should be combined with variations in cruise and cargo traffic. A "most likely" scenario is selected and the "most likely" is tempered against what the client believes is a realistic scenario. Once the most likely/realistic scenario is selected, port improvements are phased in as they are economically feasible and fit into the physical growth of the port. The client's operational comfort and minimizing negative impact on tourism during construction should also be considered. The phasing of the plans are identified as immediate (1-2) years, short range (2-5 years), long range (5-15 years), and overall vision (20 years).

With a better understanding of the entire four-step cruise ship port planning process it is easy to see the broad scope of the cruise port planning process.

(d.) Objectives

This dissertation is devoted to one small part of the port planning process that spans step (2) examination of existing port conditions and step (3) port development options. This objective of this dissertation is to provide a prediction of the future of cruise ship operations and develop consolidated planning factors associated with the design and/or expansion of new and existing cruise ship sea ports. This includes general planning factors that can be applied to origination and destination cruise ports as well as a specific design concept to better handle cruise port growth at high use origination ports.

(e.) Expected Results

The expected results from this research are far reaching. As illustrated earlier, the growth of the cruise ship industry will be significant and several factors will contribute to the growth. This will increase demand at seaports and will put cruise ships competing head to head with cargo ships for berth space. Combine this increasing demand with further environmental regulation, limiting development of wetlands, and the only solution is more efficient use of the space already developed. This means the cruise industry and port agencies will have to work closely with port planners to best optimize cruise berth usage. This will include innovations in the ways passengers arrive at the port, process through the port and the way ships are resupplied.

The future growth of the cruise industry is very promising and as a result of this dissertation, cruise port planners and designers may start to take steps to optimize cruise port operations. This dissertation provides a consolidate location for cruise port planning factors, useful in the development of any origination or destination cruise port. Furthermore, it provides a trend-setting concept borrowed from the airline industry to handle growth management for larger cruise origination ports in a safe, secure and controlled manner. Hopefully, these factors and concepts will be useful in the development and planning of future cruise ports.

(f.) Dissertation Organization

This dissertation is organized into five chapters. Chapters one and two are the introduction and literature review respectively. The main body of consolidated cruise ship port planning factors are located in chapter three. This chapter is subdivided into origination cruise ports and destination cruise ports considerations. Of specific interest in the cruise ship origination port section is the original development of the "finger

terminal" design concept for implementation in cruise origination ports. Utilization of this type of system could totally transform cruise operations and would be the means to handle the vast increase in cruise volume that is anticipated based on the forecast factors outlined previously in the Executive Summary. Upon completion of the cruise ship port planning factors, the methodology associated with the development of this dissertation is outlined in chapter four. The conclusion of the findings of this research are located in chapter five, along with some suggestions for the continued development of the Port of Miami to ensure it retains market share in the cruise industry of the future.

CHAPTER II

LITERATURE REVIEW

The topic of cruise ship port planning is very diverse with numerous factors contributing to the overall planning process. This dissertation is devoted to one small part of the port planning process. This objective of this dissertation is to provide a prediction of the future of cruise ship operations and develop consolidated planning factors associated with the design and/or expansion of new and existing cruise ship sea ports. This includes general planning factors that can be applied to origination and destination cruise ports as well as a specific design concept to better handle cruise port growth at high use origination ports.

This factors associated with cruise ship port planning are not readily available through traditional sources. All traditional port planning publications reviewed had no mention of cruise ship issues. In fact, most port planning publications have little mention of the land-side infrastructure required for interaction with ship operations of any type.

While searching through literature associated with shipping, the closest topic slightly associated with this dissertation was uncovered and it has been thoroughly studied. This topic is the study of intermodal operations with regard to containerized cargo

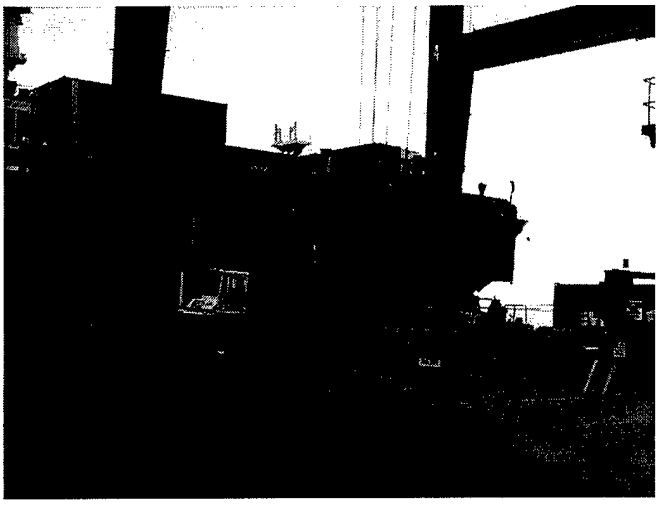


Figure 2.1 Containerized Cargo Operations

operations. This includes the movement of cargo to and from the port as well as loading and unloading from ships and processing the cargo through the port itself. The similarities between this type of cargo operation and the cruise ship operation are significant. In both cases, material is moved to the port, processed and loaded aboard a ship. That is the extent of the similarities. While they sound the same, the considerations for each situation are vastly different. This was highlighted extensively in the introduction.

After examining the limited existing literature, the next step involved evaluation of current field design practices with regard to cruise ship ports. Fortunately, the location of Florida International University in Miami, Florida, assisted this research in an immeasurable way. Through the connections of Dr. Luis Prieto-Portar, an introduction was made to Luis Ajamil of Bermelo-Ajamil and Partners Inc. This esteemed engineering firm has led the way in cruise ship port planning design and throughout the Southeastern United States and the Caribbean. The case studies provided by Bermelo-Ajamil and Partners Inc. were invaluable. This information, in the form of master plans for the cruise ports of Ensenada, Cartagena and Aruba proved useful in outlining the overall port planning concept for cruise ports. Even though this privately held information was very useful and greatly appreciated, it did not contain overall evaluations associated with the growth of the cruise ship industry, specific port planning factors, or the design concepts suggested within the dissertation to manage the growth of the cruise passenger and ship traffic.

After looking through the available literature and determining the future of the cruise ship industry, the solution for growth management became clearly obvious. The

idea to handle the growth of the industry and the ships came from concepts introduced while attending "Airport Terminal Design and Operations" taught by Dr. L. David Shen at Florida International University. Although a published textbook for this course does not exist, the concepts illustrated within this course could easily be applied to a new situation.

In summary, looking at the work of others and seeing their approach to cruise ship port planning factors was a null issue. No other research has been published specifically addressing this issue. The areas of greatest similarity are most likely with respect to containerized cargo handling and privately held design information used by engineering firms specializing in ship port design. This in conjunction with current designs utilized in airport operations are the basis for this research.

CHAPTER III

CRUISE SHIP PORT PLANNING FACTORS

Cruise ship port planning factors is a widely diverse topic with numerous variables. It is the diversity of the topic and the many factors playing into the cruise port equation that make this topic so interesting. However, explanation of this topic can quickly become tedious and confusing as the topics are interrelated and overlap one another. To simplify the explanation of cruise ship port planning factors, the topic has been subdivided into origination and destination ports. Under each of these subtopics, the planning factors have been further divided into ship accommodations and passenger accommodations. Although this may have some redundancy, this will simplify the explanation of this topic as a whole. Furthermore, it will result in a dissertation that is not only technically correct, but useful as a valuable tool for accomplishment of future research and engineering design.

A. Cruise Ship Origination Ports

The cruise ship origination port has unique characteristics not shared with a destination port. The origination port is where the ship takes aboard the passengers, fuel, food, and supplies. The typical operation of disembarking passengers just completing a cruise and embarking new passengers looking forward to a cruise takes approximately 12 hours depending on the size of the ship and the number of passengers. This requires a tremendous logistical effort by the cruise line and as a result the port must have the capacity to allow this rapid transition. The origination port must make available adequate

berthing, utility connections, fuel, and other support services. Additionally, the region around the port also has a responsibility. The air and surface transportation systems need to be sufficient to rapidly move vacationers to and from the cruise ship. Hotel accommodations should be sufficient to allow for passengers to visit the origination city before and/or after their cruise. Realizing that the cruise ship is typically not the only part of the tourist's adventure, the hosting origination port should have other nearby attractions that have significant tourism value. This helps draw the clientele, and ensures ships are filled to capacity. This is only a glimpse of the issues to be addressed in the following pages. The origination port considerations will first examine the transportation links, then move on to passenger processing, followed by hotel accommodations and excursions. Then the focus shifts from the passenger to the ship itself, looking at the physical requirements of the ship, utility requirements and support services for the ship. The origination port considerations are wrapped up with examination of port services and the potential for homeport expansion.

1. Transportation Links

Passengers arrive at the cruise ship departure city via airplane, automobile or rail. Once in the departure city they transfer from their arrival means to the port area. For airport arrivals this is accomplished by transferring to rail transit, renting a car and driving the remaining distance to the port, or travelling via prearranged bus, taxi or limousine. Arrival by rail requires transfers similar to air arrival passengers. Driving arrivals have the ability to transit all the way to the port area without transferring modes of transit. Four critical questions should be answered to effectively evaluate the transportation links for an origination port. Of significant importance are:

1. The information provided by the cruise lines prior to arrival at the port?
2. The breakdown of passengers driving or flying to the departure city?
3. The user costs associated with each mode of travel?
4. What enhancements can be made to improve the existing systems?

This segment will give the passengers perspective as they arrive at the departure city and their transition to the port. Furthermore, this segment will also discuss other ground transportation requirements generated by the homeporting cruise ship.

(a.) Airport and Rail Arrivals

Airport and high-speed rail arrivals can transit to the cruise ship port by a couple of different means once they have arrived at the origination port city. These can be broken down most simply as light rail or road. How passengers travel to the port is usually dependent on the amount of traffic moving from the airport to the cruise ship port, the type of infrastructure developed to serve arriving passengers, and the type of connection between the different means of passenger transportation.

In Europe and Asia, the high-speed rail and light rail infrastructure are fully developed when compared to the United States. European and Asian high-speed rail systems closely mirror the operation of U.S. commuter air flights. However, unlike U.S. air carriers, the European and Asian high-speed rail systems carrying passengers between major cities, usually have light rail connections collocated at the same facility. This interconnection allows passengers to travel seamlessly within their destination city. Many times, passengers can easily transfer directly from the airport or high-speed rail to the seaport. The European and Asian embrace of the passenger intramodal concept in larger population centers has eliminated many of the congestion problems associated with automotive traffic encountered within the United States.

Currently in the United States, rail transit is not used to make the connection from the airport to the seaport for a couple of reasons. Rail transit has not been fully embraced in the United States and the nature of cruise ship operations requires peak demand of the rail lines on a Friday, Saturday and Sunday. This may not coincide effectively with commuter use of the same rail line into the port facility. So most U.S. communities, including those adjacent to the largest cruise ports in the world have not embraced the use of rail into port facilities for commuter/passenger traffic. However, with the growing population within the South Florida area, and the automotive traffic that accompanies such growth, a shift in policy to alleviate automotive traffic congestion may be on the way. Evidence of this is already available with the new development of the Miami International Airport Intramodal Center and the expansion of the Tri-Rail system to

include another set of tracks within the rail corridor. These are two small steps that

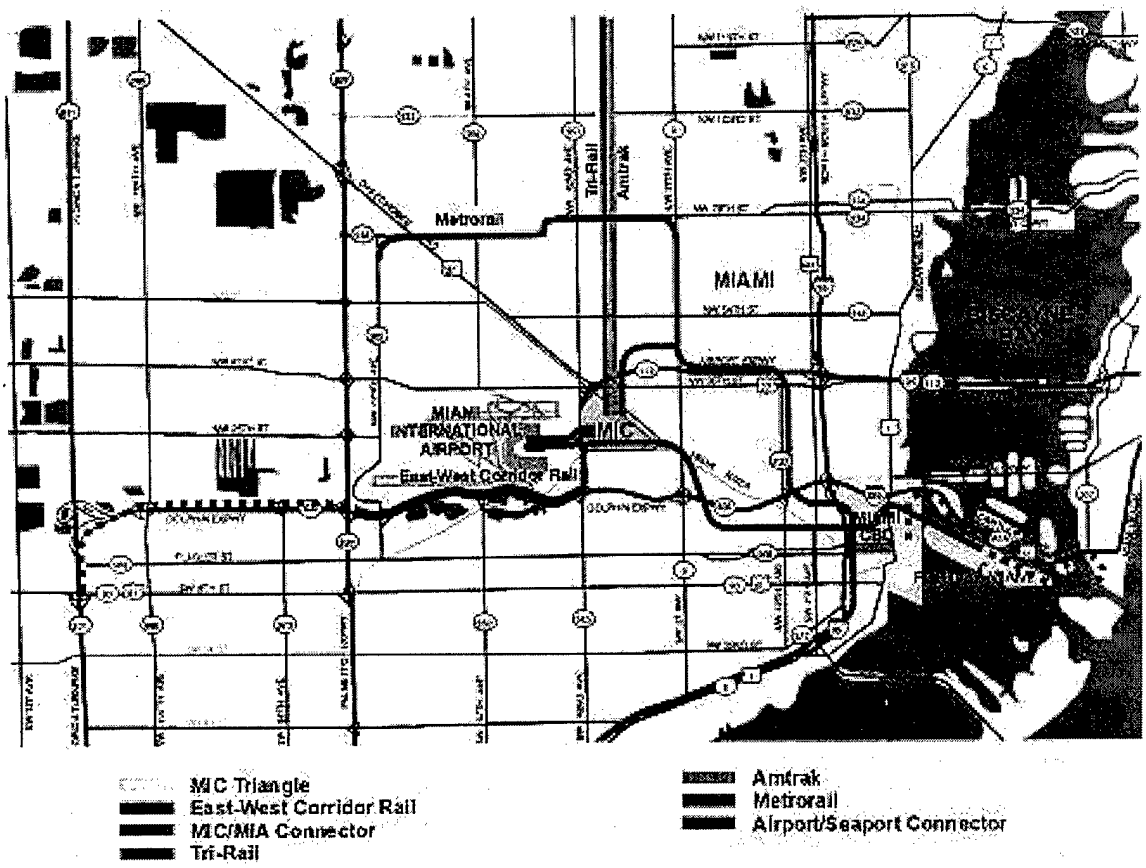


Figure 3.A.1.1 Miami Intramodal Center Transportation Links

provide some insight into the future of rail travel adjacent to two of the largest cruise ship ports in the world.

But for now, the roads are the primary means of transit from the airport to the cruise ship port within the United States. From the airport, the typical passenger transits to the

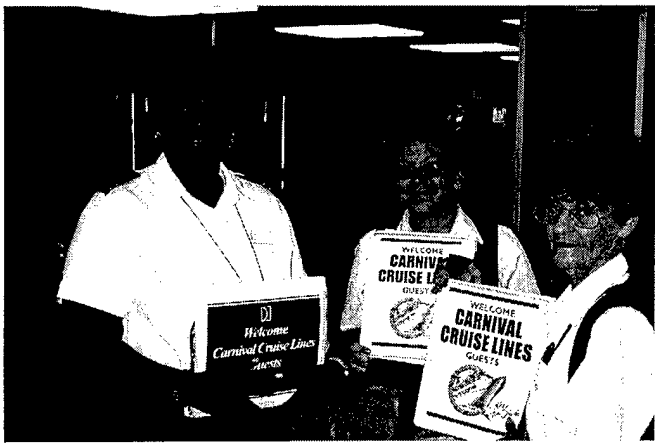


Figure 3.A.1.2 Cruise Representatives at MIA

cruise ship port via taxi, limousine, rental car or most likely bus (motor coach). Operators of taxis, limousines and buses have different concerns than those passengers operating rental cars. The operators of these transportation services just want to get the customer to their destination as soon as possible with minimum cost. They are typically familiar with the area they are driving in and signage to the port is not an issue. They are not concerned about parking at the cruise ship terminal area, because they are dropping off passengers and departing to collect other customers. Most cruise ship operations offer transfers from the airport to the cruise ship terminal. This is usually in the form of a bus and the typical operation starts at the airport arrival baggage claim area of the airport. At this location a couple of cruise line representatives direct passengers to the curb where the bus is loading passengers to transit to the port. This is a very efficient and typically inexpensive means of travel, but isn't always the most convenient for the passengers. At times it may give the passenger a feeling of being cattle herded out to pasture or to slaughter. Of course the other side of the coin is using a taxi or limousine to accomplish the same task. In this case, passengers must arrange for their own transit once they arrive at the airport. This can be an

Figure 3.A.1.3 Coach Transfer to Cruise Port

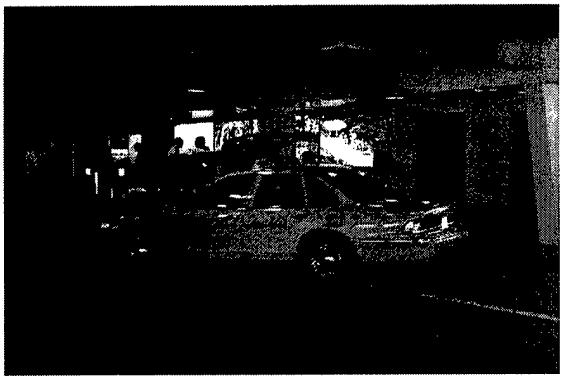


Figure 3.A.1.4 Taxi Transfer to Cruise Port

economical solution with small groups sharing the transit cost, or in countries where taxi/limousine transportation is very economical.

The most difficult and least economical mode of transit from the airport to the cruise terminal is via rental car. This requires the rental of the car upon arrival, driving to the port, finding and paying for a parking spot. When added up, the cost of the car and parking is a significant expenses. A special challenge for the rental car operator is finding the cruise ship terminal from the airport when they are typically unfamiliar with the departure city. Directions from the rental car agency can be helpful, but after three left turns and five right turns the operator invariably gets lost. Adequate signage from the airport to the cruise ship terminal is crucial to minimize the problem of "lost passengers". The "lost passenger" syndrome is a similar problem faced by driving arrivals to the port.

(b.) Driving Arrivals

Driving arrivals to ports in the United States usually carry on a major portion of their trip via interstate travel. The first person to assist driving arrivals is the travel agency or cruise ship line. This is best accomplished with a map highlighting the location of the port departure city with some basic directions to the port of interest. This is a great start and sets the vacationer on his/her way to the port city. Many times this information is available on the cruise line website. With map in hand, the travel begins and hopefully all is crystal clear and the traveler arrives, without problem, but most likely the traveler will not get a map, he or she will only get a

Figure 3.A.1.5 Street Level Signage

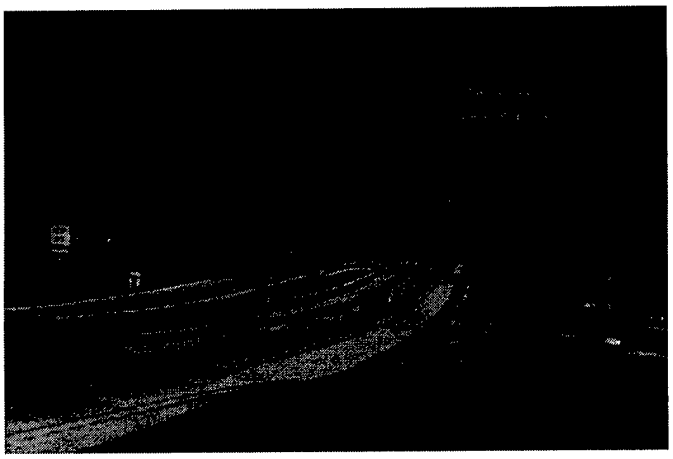


Figure 3.A.1.6 Illuminated Cruise Port Signage

contact number at the port, in the event he or she get into trouble. Since most of these travelers are on their own, as an aide to the traveler, each origination port should have some signage to make transit to the port easier. The signage should be easily visible and at regular intervals on the interstate system, down to the local street level. Also considered in placement of the signs should be the path of least resistance. This makes it easier for the traveler to arrive safely at the port. Safety is another issue that calls for signage. Signs can direct passengers around less favorable sections of a town and through physically safer areas. Furthermore, signage can direct traffic onto routes that are more aesthetically pleasing. This is an important consideration given travelers are on vacation and aesthetic beauty is one of the prime considerations of travelers. It should also be a prime consideration of cities if they want to attract these visitors back for longer stays. Once at the port area, the signage should be complete. It should direct passengers to the baggage drop off area designated for cars, and then to parking areas. In many instances, this aspect of the port plan is neglected and the passenger is left to "figure it out". Signage is not only helpful for the rental car operator, but also bus drivers, taxi and limousine operators. It serves a function in reminding people which direction to travel.

The interim resting location for vehicles while the passengers are on the cruise is the parking lot/garage, which provides several challenges for the designer and the potential for significant reward for the port.

(c.) Parking

The first critical question is "How many parking spaces should be provided per passenger?" This approximation is best utilized as the passenger capacities of most current ships are known and this "per passenger" approximation can be applied to other transportation and ship utility requirements, just to name a few. The answer to this question is dependent on many factors. The first being, what percentage of passengers drive versus take the train, fly, or take one of the cruise-sponsored buses. The second factor is how far the port is from other transportation links. The third factor is dependent on the geographic location of the origination port, taking into consideration if it is on an island or connected to a large land mass. The final factor is the travel nature of the society and its sentiment regarding public transportation. Generally speaking, within the United States a much greater percentage of travelers will drive their vehicles and require parking at the port versus a similar cruise departing from a European or Asian port.

The following table estimates the average percentage of passengers driving to major cruise port areas around the world.

Port	% Passengers Driving
Florida Ports	30
Port of Los Angeles	20
Port of New York	20
European Ports	10
Asian Ports	5

Table 3.A.1.1 Major Cruise Locations and Percentage of Passengers Driving

Using Table 3.A.1.1 (CLIA) is sufficient to approximate increases in parking associated with increases in cruise ship operations at origination ports. From the table, it is easy to see that for European and Asian origination ports, parking is not as big a consideration as in the United States. This is largely due to readily available public transportation and the positive sentiment and economic value of its use. Whereas the average estimate throughout the United States for parking required by passengers driving to the port is 20-30%, in Europe and Asia, the number more closely approaches 5-10%.

Figure 3.A.1.7 Cruise Port Parking Garage

The local municipalities operating the port are also interested in the parking requirement, because this is an excellent source of revenue. With daily parking rates approaching $8.00 to $12.00 daily, the revenue generated is tremendous and most parking structures rapidly pay for themselves and turn into future money machines for the municipality. For example, the 3500 parking spaces located in the two parking garages at Port Everglades earned $4.4 million in FY 99. The high profitability of these structures has prompted the construction

of 1000 additional spaces in the midport garage and planned future expansion in the northport parking garage.

Another consideration is the safety/security of the parking area. Most parking garages have some sort of security working in the area and have cameras to videotape any activities within the parking area. Some parking garages are dual usage like those at Port Everglades and the Port of Miami. Port employees, and special events use these garages as well as cruise ship passengers. This ensures continued use throughout the year. At Port Canaveral, each cruise line controls its own parking area. The cruise line opens the parking area when its ship is in port, then closes it upon departure. This helps ensure security of the passengers' automobiles. In the end, the overriding concerns for the traveler are typically cost and ease of use of the transportation system. Even the best engineered intramodal center can be overcome by these factors. The best example of this is the relatively new Hong Kong International Airport. This well thought out facility used a light rail system to connect it with the population center of Hong Kong and it works flawlessly. But for many travelers, the rail system is expensive transportation to the airport. Ingenuity is a great thing and many travelers are now using charter bus service to commute to the airport instead of the light

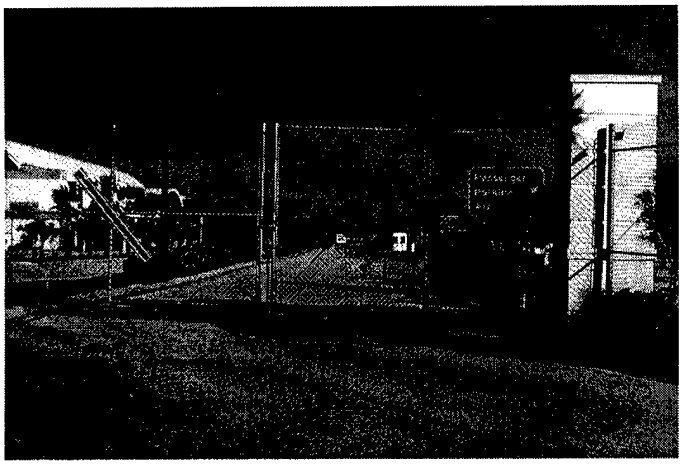


Figure 3.A.1.8 Secured Port Canaveral Parking Area

rail system. In the end, the most economical and convenient mode of travel will win out for each passenger.

(d.) Aesthetic Beauty of the Port and its Surroundings

As mentioned earlier, the clientele serviced by the Cruise Ship Industry are typically vacation travelers. And like most travelers on vacation they want to be surrounded by a pleasant and aesthetically pleasing environment. This concept should be embraced from the time the vacationers depart their home for their cruise vacation. Unfortunately, the circumstances at the home end of their trip can't be altered in a fiscally responsible manner to make the commute to the airport or down the highway more pleasant. But when looking at the entire intramodal process, making the traveler's experience on the receiving end more enjoyable is a reasonable goal. This includes a pleasant reception at the airport and/or accurate and plentiful signage with easy to follow directions to the port.

The port surroundings should be aesthetically pleasing. This encompasses all of the typical traffic pathways into the port area. Where appropriate, facades should be constructed to hide industrial areas from the street and passenger traffic line of site. As a general practice, the port is best divided into a vacation side and a working side. The working side includes all the cargo and/or non-cruise operations.

Figure 3.A.1.9 Scenic Area for Improvement

The vacation side is dedicated to cruise operations. This isolates passengers from the

industrial aspect of the port and promotes a positive vacation-oriented feeling. This is further enhanced by giving the port and the area leading into it a cosmetic facelift that makes it more appealing to passengers and sets the standard for cruise port appearance and function. Although not considered an infrastructure development, port cosmetics are great aesthetic enhancements improving the public perception of the port. The perception of the port is a key factor that will keep vacationers coming back for more.

(e.) Ground Transportation Adequacy

In the case of air and rail arrivals, is the ground transportation fleet adequate to support home porting operations? Consideration must be given to account for passenger transport to and from airports and rail stations on peak days. To accomplish this, a summary of all available tourist transportation is made, and turn-around times between the port and the airport are calculated. The ground transportation must be adequate to support typical daily demands and be able to ramp-up for additional demand when the ship is in port and turning around for a new cruise. Primarily, this traffic is supported by buses, because they are the most efficient means of travel, but consideration should also be given to van services and taxis.

Table 3.A.1.2 Example Private Use Tour Bus, Van and Taxi Capacity

Company	Vehicle Type	Quantity	Pax Capacity	Total Capacity
Tour America	Bus	5	40 Pax	200 Pax
Tour Florida	Bus	3	50 Pax	150 Pax
Van's R Us	Shuttle Vans	15	15 Pax	225 Pax
Taxi Time	Taxi – Vans	40	6 Pax	240 Pax
			Total Pax	815 Pax

Once an accounting for traffic variations from the airport to the ship on peak days has been accomplished, the facilities and manpower to assist passengers and their baggage moving should be evaluated to ensure adequacy.

In the previous table, transportation for 815 passengers may not seem sufficient, but several other factors need to be addressed before making a final determination. What is the current use rate of these vehicles? If they are not chartered or in use, the potential for their use while the ship is in port is increased. If they are in use, can some of the vehicles be dedicated to the ship in question? Even with all 815 passengers seats filled, is that enough to accommodate the ship? It most cases it may be, but bus/shuttle service may have to make multiple trips to the airport to pick up passengers. To best determine the number of trips that can be made while a ship is in port, the time required to roundtrip between the airport and seaport must be determined. Lastly, special consideration should be given to the use of chartered buses over the use of taxis and smaller shuttles. The larger vehicles are more efficient at moving people and baggage and are easier to control from a logistical tracking standpoint. For example, is it easier to keep track of one bus or eight taxis? Each carries roughly the same number of passengers. Once all these factors and an inventory of transportation vehicles for hire are taken into consideration, an evaluation of ground transportation adequacy can be made.

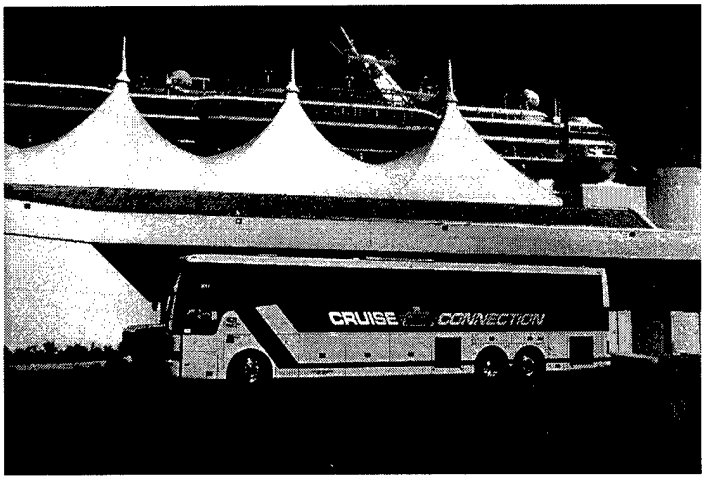


Figure 3.A.1.10 Cruise Ship Bus Connection

To complete the example already started, the cruise line has decided that for logistical reasons they will only use vehicles with a capacity of 30 or more passengers. At the port city in question, The Tour Florida buses are 100% utilized and the Tour America buses are 40% utilized on the days of interest (the day the ship is in port). Given these considerations, the 815 passenger seats from the airport quickly dwindles down to 200 passengers – the 40% utilization, arriving at 120 passenger seats available. Bear in mind that the roundtrip from the airport to the seaport during average conditions is 1 hour, which includes passenger loading and unloading. The estimated number of passengers for the ship of interest is 1200. Given that passengers can only load from roughly 1200 until 1700 local time, five roundtrips per bus can be accommodated. Therefore, (5RT)*(40pax/bus) = 200 pax/bus/day therefore, to meet the minimum requirement, 1200 pax/200 pax/bus/day = 6 buses minimum. The Tour America company has three buses available, but three more are required to meet the minimum. Beyond that amount a "cushion" of 10-20% should be figured in to allow for partially full buses. What results is adding four buses to the Tour America Company, or adding the capacity of these buses from another source. In either case, the arrangement and commitment for this ground transportation must be made prior to establishing the cruise. In most cases, the ground transportation for the origination

Figure 3.A.1.11 Airport Shuttle

port may be slightly inadequate or stretched thin when new ships are added to the port, unless the ships are replacing older vessels of similar size. In this case, new ground transportation companies will emerge to meet the demand, existing companies will expand to meet the demand, or the cruise line may add a bus service.

The importance of the Transportation Links and their efficiency can not be underestimated. Transporting to and from the port is the cruise passenger's first and last interaction with the origination port city and the cruise line. It is crucial that passengers start off their cruise with a positive feeling and end their vacation with a positive feeling. That is one of the key ingredients that keeps passengers coming back for follow-on cruises and/or visits to the port city. It takes the cooperative effort of all parties, the airport authority, cruise lines, local municipality and port authority to best pull off this production. It is in the best interest of all these agencies to work together and be prosperous. Now that transportation to and from the port has been thoroughly discussed, interaction with the passengers and the port begins with passenger processing.

2. Passenger Processing

Passenger processing is a multi-stepped system varying at each origination port. Furthermore, it varies for passengers departing the port and passengers completing a cruise. Passenger processing will be addressed with outgoing passenger concerns first, then returning passengers. Lastly, overall terminal configuration to address both activities simultaneously will be covered.

(a.) Outbound Passengers

Outbound passengers from around the world follow a fairly typical pattern of events in the ship boarding process. Prior to the boarding process, the passengers, depending on country, may undergo some sort of passport check, similar to that conducted by the Immigration and Naturalization Service (INS) when passengers' return to the United States. Then the passengers and his or her baggage proceed to a ticketing counter for cabin assignments. Due to the large volume of passengers, these counters are usually divided by cruise ship and then alphabetically by passengers last names to expedite the process. Once the passenger has the "keys" to their floating hotel room, the baggage is dropped off and manhandled onto the ship. On occasion, the luggage may be pre-checked to the room on the ship, much like luggage is curb checked at the airport, prior to getting a seat assignment. In these cases, the baggage

Figure 3.A.2.1 Passport Control

would be brought aboard ship, compared against cabin assignments, and then delivered to the cabin. In some instances the baggage may be inspected before boarding the ship, but in most cases, it flows freely onto the ship with minimal or no inspection. The baggage is carried from the terminal area, to the ship at the lower level and then moved onto the ship. The crew then moves the bags to the assigned passenger cabins.

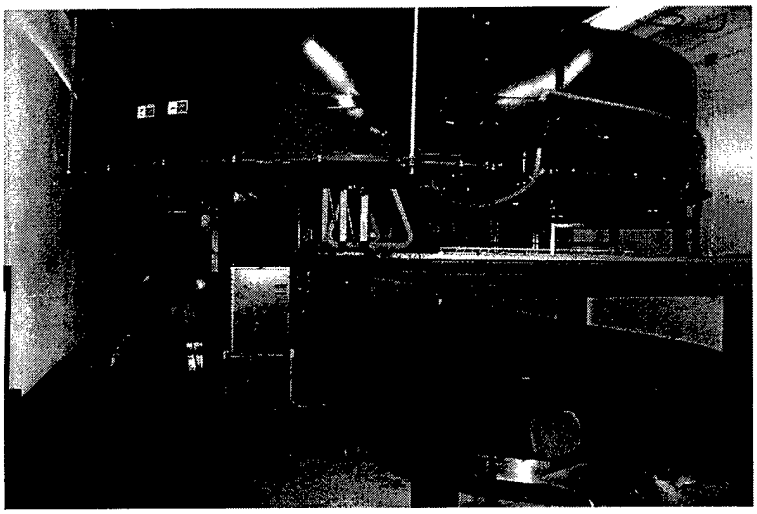


Figure 3.A.2.2 Baggage Handling and Inspection

Simultaneously, the passengers typically board the ship on an upper deck and start to get acquainted with their new surroundings for the next few days.

This description gives the passengers' perspective of what is going on and it is a fairly simple process that requires a great amount of manpower. And although this process sounds simple, several key enhancements can be made to make it run smoother, safer and more efficiently. Those enhancements will be proposed later in the passenger processing area.

(b.) Inbound Passengers

Worldwide, inbound passengers follow a fairly typical pattern also. To expedite the disembarkation process, passengers pack up their luggage the evening before arrival and set them outside their cabin. During the night, the crew then relocates their baggage

to a hold lower in the ship for easy transit ashore upon arrival. Due to the large volume of passengers and to ensure an orderly disembarkation of the ship, the passengers are provided with colored and/or numbered tickets assisting the disembarkation process. The colored/numbered tickets are called and groups of passengers holding tickets with the color/number are allowed to disembark.

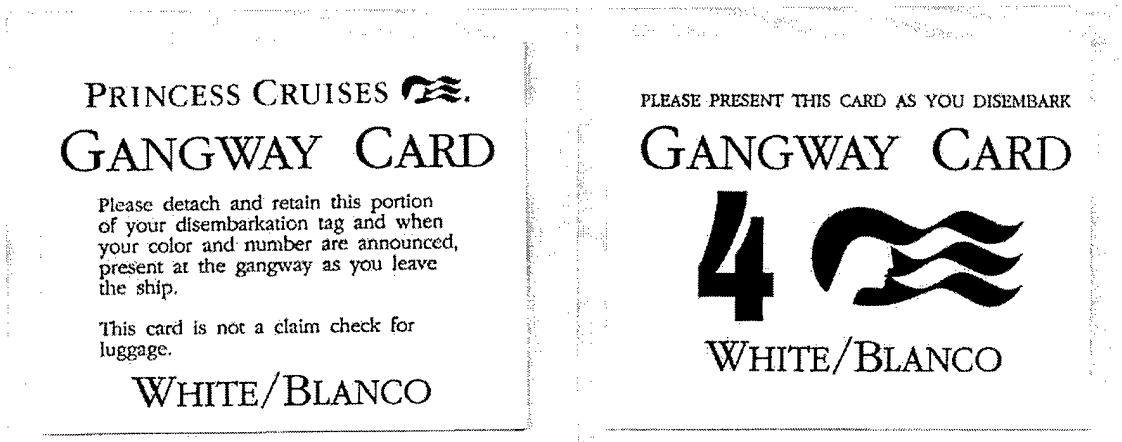


Figure 3.A.2.3 Disembarkation Gangway Cards

The debarkation time associated with each ticket is established based upon passenger preference and to ensure passengers can make connecting travel arrangements to expedite their return home. After disembarking the ship, passengers must process through some type of inspection station. For lack of better terminology, we will use the standards used within the United States. The Federal Inspection Station (FIS) is an area within the port where clearance of passengers, baggage and cargo arriving from international ports can be cleared into the country. The terminology and names of the organizations used are particular to the United States, but the process and the types of agencies within the FIS are typical of what is found the world over with regard to passenger processing.

(c.) Federal Inspection Station - Customs and Immigration Operations

(i.) FIS Agencies

Ships traveling to international destinations must be inspected when they return to their homeport. The passengers, ship, crew, baggage and cargo must all be evaluated before entering the country. This operation requires space that must be accounted for in the design of a cruise ship terminal. The Federal Inspection Station is a location within the port that contains the combined activities of several agencies to rapidly and thoroughly inspect and clear passengers, baggage and other cargo into the country. The names of the organizations and how they operate may vary slightly from country to county, but the generic concept of passenger and baggage inspection is similar. Agencies involved include the Immigration and Naturalization Service (INS), The United States Customs Service (USCS), the Public Health Service (PHS), The United States Fish and Wildlife Service (FWS) and the Animal and Plant Health Inspection Service (APHIS).

The Immigration and Naturalization Service (INS), part of the Department of Justice, examines all persons arriving in the United States to determine their admissibility under the provisions of the Immigration and Nationality Act. Other countries have comparable agencies under different names for this task and it is typically the first part of the FIS process greeting international arrival passengers. As mentioned earlier, many countries also require departing passengers to process through a similar facility when leaving the country.

The Customs Service (USCS), part of the Department of the Treasury, controls the entrance and clearance of all baggage and cargo brought into and departing the country. This daunting task is accomplished by inspecting passengers, crew members,

baggage and cargo arriving and departing the country. Items entering the country may be closely scrutinized and the Customs official is empowered by a series of regulations to determine if items are subject to duty (taxation), they are duty free or they are prohibited from entry into the country or exit the country.

The Public Health Service (PHS), part of the Department of Health and Human Service is tasked to prevent the introduction, transmission, or spread of communicable diseases from foreign countries into the United States.

The Animal and Plant Health Inspection Station (APHIS), part of the U.S. Department of Agriculture, is charged with preventing the introduction of harmful plants and animals into the United States. They inspect all plants and animals entering the country and as a general rule do not allow cruise passengers to enter the country with any plants, fruits or vegetables to curb the spread of plant borne disease. Animals are closely inspected and may require special documentation and/or quarantine as a precautionary measure to ensure public safety.

(ii.) The FIS Process

The first step for arriving passengers is to turn over all plants, fruits or vegetables to Animal Plant and Health Inspection Service (APHIS). They must then process through the Immigration and Naturalization Service (INS) with appropriate passport documentation. Upon completion of this, the disembarking passengers collect their baggage. The cruise line and land bound baggage handlers transfer baggage in a secured area with limited

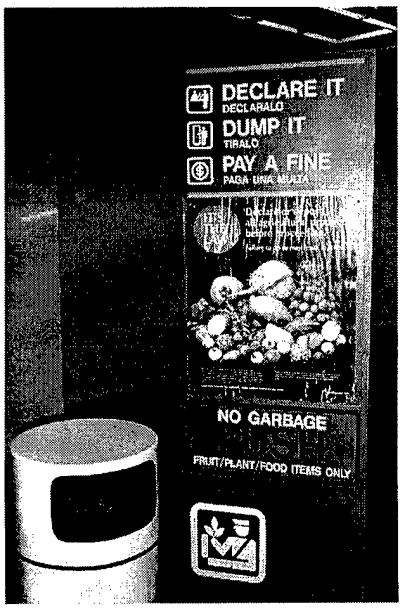


Figure 3.A.2.4 APHIS Signage

access from the ship back to the terminal area and typically sort it by the colored/numbered baggage tags. After collecting their baggage, passengers, process through the United States Customs Service (USCS), declaring all items purchased while outside the United States. This gives the Customs official the opportunity to inspect baggage and/or levy duties against items purchased outside the country. The Public Health Service and The Fish and Wildlife Service typically don't interact with the passengers as much as the other agencies, unless they are notified by one of the other inspection agencies of a potential problem.

Disembarking passengers then proceed out a set of automatic one-way doors opening outward to their next mode of transportation. This doorway must be kept clear of passengers stopping to augment the outward flow of passengers. They may either board a bus or flag down a taxi to the airport, or locate their vehicle, load up their baggage and start driving home. This description gives the passengers' perspective of what is going on and it is a fairly simple process requiring a great amount of manpower to move the baggage. Passenger processing sounds simple, but several key enhancements can be made to make it run more smoothly, more safely and more efficiently. For example, a simple improvement for most passenger processing areas would be the addition of free baggage carts. Many passengers feel

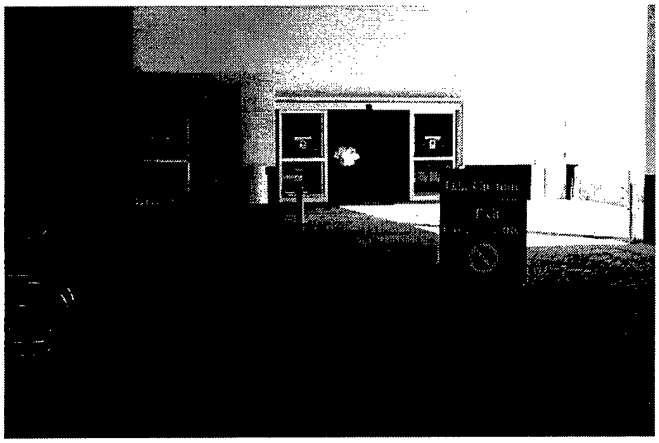


Figure 3.A.2.5 U.S. Customs Exit

uneasy entrusting their luggage to a stranger and given that most cruises are one week in duration, passengers are typically carrying a great deal of baggage. Baggage carts would allow passengers to move easily through the inspection process, all the way to the parking area if necessary. They feel empowered with their own baggage and it would speed up the entire process, especially for elderly passengers.

(iii.) FIS Physical Requirements

Behind the scenes and away from the public eye, each of these previously mentioned agencies has requirements to accomplish their job in a productive and professional manner. Lets first examine the general requirements, then follow on with the specific requirements of each agency. In general, the entire FIS should be monitored with a closed circuit television system with a master control module. This is a valuable tool that can provide photo documentation of incidents and tip off agents of suspicious activity. The other generic facilities are more geared to the comfort of the FIS employees. They should have an employee locker room area of size sufficient to support a locker for each full time employee assigned to passenger inspection. An area for breaks and lunch should also be provided as well as male and female toilets that are isolated from use by the public. Each agency also has specific requirements as follows.

The INS require a booth with computer access to process passenger passports. The key is determining how many control booths are required to handle the volume of passengers processing back into the United States. The following equations to determine booth quantity and waiting line space requirements were adapted from the International Air Transportation Association (IATA), *Airport Terminal Reference Manual*, 7th Edition, Montreal, Canada, 1989.

Passport Control – Arrival

Data Required: d = peak hour number of arrival passengers

t = average processing time per passenger

Control positions required: N= (d*t)/60 positions + 10 %

Example: d = 1200 passengers, t = 0.5 minutes

N = (1200 passengers)(0.5 minutes)/(60 min/hour) = 10 positions + 10%

use 11 positions

Waiting Line Area – Passport Control - Arrival

Data Required: d = peak hour number of arrival passengers

s = space required per passenger (square meters)

Assumptions: s = 1 square meter

50% of peak hour number of passengers arrive within first 15 minutes

Area Required: A = s x (15min/60 min/hour) x (4d/2 – d) = 0.25d square meters

Example: d = 1200 passengers

A = 0.25 (1200) = 300 square meters

Note: Assuming arrival rates of peak hour number of passengers as follows:

1) 50% within the first 10 minutes

2) 50% within the first 20 minutes

1) A = s x (10 minutes/60 minutes/hour) x (6d/2 – d) = 0.33d = 400 square meters

2) A = s x (20 minutes/60 minutes/hour) x (3d/2 – d) = 0.17d = 200 square meters

For passengers who have passport problems and frustrate the system, a small waiting room should be available. This will give the INS officers the opportunity to clear the problem without making the passengers at the end of the line waiting an excessive amount of time.

The U.S. Customs Service has several requirements that include a Treasury Enforcement Communication System (TECS) Room, Baggage inspection counters, search rooms, cashier booths for fines and taxes, office area for supervisors, general office area, vault and agent space for inspection operations. The requirements for Customs check areas are directly linked to the level of inspection desired. For planning purposes, Customs officials should be consulted with to determine their desired level of inspection. This will ensure that adequate space is constructed without unnecessary space being developed. In the event that Customs inspections are based on the percentage of passenger traffic, the following formula can be used.

Customs Positions – Arrival

Required Data: e = peak hour arrival passengers

f = proportion of passengers to be customs checked

t = average processing time per passengers (minutes)

Number of Customs positions required: $N = e \times f \times t/60$

Example: e = 2500 passengers, f = 0.25, t = 2 minutes

N = [(2500 pax)(0.25)(2 min)]/ 60

N = 20.83 positions so use 21 positions (+10%) = 23 positions required

Waiting Line Area – Customs - Arrival

Data Required: e = peak hour number of arrival passengers

f = proportion of passengers to be Customs checked

s = space required per passenger (square meters)

Assumptions: s = 2 square meters (with baggage)

50% of peak hour passengers arrive within first 20 minutes

Area Required: A = f x s x (20min/60 min/hour) x (3e/2 - e) = 0.25ef square meters

Example: d = 2500 passengers

f = 0.25

A = (0.25)(2500)(0.25) = 156 square meters + 10%

Additionally, USCS will require search rooms to check passengers that are suspected of carrying contraband. The quantity and size of these rooms as well as other special requirements can be found in the table at the end of this section.

The Public Health Service (PHS) requires office space and an isolation area that is adjacent to the FIS inspection area. The isolation area consists of an ante-room with a lavatory and shower, and isolation room, and an adjacent private toilet with shower, water closet and lavatory. The air circulated through the isolation room may be heated or cooled by the overall FIS Heating Ventilation and Air Conditioning (HVAC) system, but it must be vented directly to the outside by a separate exhaust system. Recirculation of the air within the area or facility is not permitted. This is to prevent contamination from spreading outside the isolation area and possibly infecting other passengers. The isolation area must be at least 160 square feet and have the capability of accommodating a hospital bed, bedside stand and chair.

The Animal and Plant and Health Inspection Service (APHIS) personnel work in cooperation with the U.S. Customs Service in the inspection of passengers' baggage. Therefore, they require space adjacent to the USCS baggage inspection area. This area needs physical and visual access to the area. The APHIS office and laboratory are ordinarily separated with a full partition and a door. This area requires adequate electrical outlets and lighting to support lab operations. Additional space may be required for a supervisor along with a climate controlled area for detector dogs.

Since most cruise ports don't have all the necessary facilities to support full scale inspection of passengers and baggage, the guidelines used for such operations are minimal. The best source for full scale operation of a FIS have been developed through airport trial and error. The following table and formulas from the International Air Transportation Association (IATA) are good starting points for space requirements for a FIS at a cruise ship port. This is a starting point, because airports are utilized a greater percentage of the time whereas cruise ports remain vacant for durations or are seasonal. This should be taken into consideration when sizing the FIS, along with the manpower that will be dedicated to accomplish the FIS tasks.

Table 3.A.2.1
FEDERAL INSPECTION SERVICES
SPACE AND FACILITY REQUIREMENTS AT INTERNATIONAL AIRPORTS

Passengers per hour	800	1400	2000
U.S Immigration and Naturalization			
# of Piggyback Booths	7	12	17
General Office Space	1300	2150	3000
Conference/Training	200	250	300
Break/Lunch Room	200	200	300
Secondary Inspection Room	250	375	600
Interview Room(s)	80 (1)	80ea. (2)	80 ea. (3)
Supervisor's Office (s)	150(1)	150 ea. (2)	150 ea. (2)
Port Director's Office	200	200	225
Clerk/Reception	160	160	160
Employee Locker and Toilet	as required	as required	as required
Adit/Lab	150	150	150
Storage	100	100	100
Hold Rooms w/Toilet	225	225	225 ea. (2)
Computer Room	100	100	100
U.S. Public Health Service			
Supervisor's Office	200	200	200
Clerk/Reception	150	150	150
General Office Space	400	400	400
Isolation area	160	160	160
U.S. Customs Service			
# of Piggyback Booths	7	12	17
Customs Supervisor	300	400	500
Customs Office	800	1400	2000
In-Bond Room	200	400	500
Cashier(s)	as required	as required	as required
TECS Room (lockable room)	150	200	200
Search Rooms	80 ea. (2)	80 ea. (2)	80 ea. (2)
Public Space w/Counter	150	200	250
Storage Room	150	200	200
Airport Director and Secretary	350	350	350
Conference and Training Room	400	500	600
Customs Patrol	300	400	500
Employee Locker and Toilet	as required	as required	as required
Animal & Plant Health Inspection Service			
Officer in Charge	200	200	200
Inspector's Office	440	750	1200
Laboratory	220	400	450
Garbage Disposal Unit (Horsepower)	5	10	10 or more
Supervisor's Office	150	250	300
Clerk/Stenographer	-	150	250
Storage	100	100	100
Conference/Training	150	200	200
Break/Lunch Room	150	200	200

(iv.) FIS Variations – Cruise Port vs. Airport

At the cruise port, U.S. Customs officials are usually most concerned with material being brought into the United States. Most pieces of luggage are not searched by any means. However, the Port of Miami has installed and is using x-ray equipment to check baggage for contraband. Furthermore, drug sniffing dogs would be an excellent deterrent and easily utilized to check passengers and baggage as they exit ships, much like they do in airports. Unlike airport passengers, the U.S. Customs officers do not look for passenger profiles and subject them to searches as they disembark the ship. On top of that, the Customs officers do not have the required facilities to detain passengers or search them upon arrival at each terminal. To conduct this type of operation would involve a huge investment of capital into facilities and manpower with a minimal return in detecting contraband. A full scale Federal Inspection Station evaluation worksheet is included in Appendix A.

At the airport, the Customs service is much more concentrated and has the ability to search passengers and their baggage more thoroughly. This is mostly due to the large number of international passengers flying through airports on a daily basis versus the relatively small number traveling through cruise ports.

Figure 3.A.2.6 Baggage Transfer from Port to Airport

A key issue for cruise passengers operating from destination ports outside the United States is does the port have customs free clearing of cruise passengers. This is the situation where passengers taking a cruise from Aruba (as the origination port) can leave the ship, process Customs in Aruba, then fly home and land in a domestic U.S. air terminal. This eliminates the need for processing through U.S. Customs at the end of the trip and is a tremendous time saver for the cruise passenger. This service is currently allowed in limited markets such as Aruba, San Juan and Nassau, allowing for the seamless transfer of luggage between the cruise ship and airport.

(d.) Passenger Processing Areas

With the introduction of each new ship, the cruise lines would like development of a modern new terminal to process passengers onto the new ship. This idealized situation does have some merits. A new terminal would most effectively interact with the ship and could provide specific services not rendered by an older terminal. For example, many of the older terminals now in use were designed for ships in the 400-600 foot range carrying upwards of a thousand passengers.

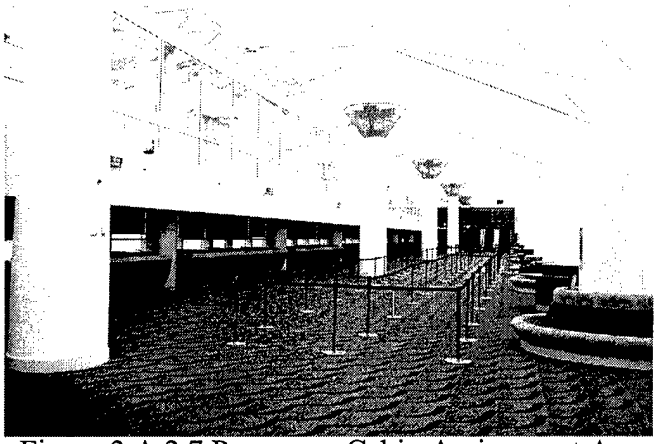


Figure 3.A.2.7 Passenger Cabin Assignment Area

The current mega-ships are approaching 1000 feet in length and carry 3000 passengers. The old terminals don't have adequate facilities to accommodate the influx of passengers in a timely manner. Due to the spacing between the older terminals, they are not situated to ideally serve the ship. In most cases, a single ship occupies the terminal space that

used to serve several smaller ships in smaller berths. Furthermore, they don't have the utility infrastructure to support newer ships. The down side is the cost of the new terminal and who typically bears the burden of that cost. In most cases, the terminals are owned by the port authority and realistically, they are only used 2 or 3 days per week. Large capital investments for structures that spend more than 50% of the time idle is unrealistic. The solution is to either run cruise ships out of the port seven days a week utilizing a highly effective terminal structure or have multi-use terminals that can handle passengers two or three days a week and cargo for the remaining days to approach 100% utilization. The bottom line is that port authorities want to get the biggest "bang for their buck" to best accommodate the passengers, cruise lines and ensure they have enough space to handle the highly profitable cargo operations.

Provided below are two concepts for the current and future trends in terminal design to best accommodate the requirements of an origination port. This overview will go in two directions. The first design concept is a cruise ship terminal with similarities to that of an airline terminal, dubbed the Centralized Cruise Finger Terminal and the second design concept is a cruise ship terminal as part of a multi-use port facility. In both of these design concepts, it is important to realize that the bulkhead level associated with port operations is reserved for industrial operations associated with the resupply of the ship. This includes food, fuel, water, baggage handling and any other services required to turn the ship around in a minimal amount of time.

(i.) Centralized Cruise Finger Terminal

The centralized cruise finger terminal is similar to an airport terminal in several ways. It starts with a curb drop area for passengers and luggage with lanes for buses,

passenger vehicles and taxis all gaining access to the second floor of the passenger intermodal center. After exiting the appropriate ground transportation. Using the cruise tickets as a reference, along with pre-supplied baggage tags by the cruise line, bags can be immediately curb checked. This lightens the load for the passenger, and starts the vacation enjoyment. The luggage is placed on conveyors to a centralized baggage

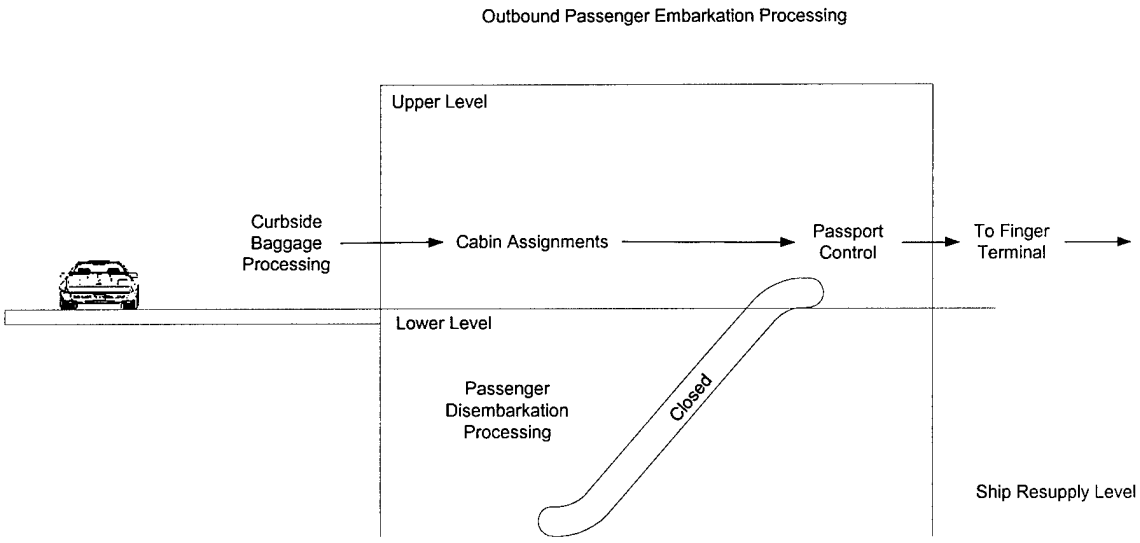


Figure 3.A.2.8 Multilevel Centralized Outbound Passenger Processing Concept

handling area. This minimizes the amount of manhandling required by baggage handlers. For safety, the centralized baggage handling system can x-ray bags in bulk. After dropping off checked baggage, the passengers enter the intermodal center at the second floor and proceed to the ticketing counter where they are checked in, assigned cabins and provided with cabin keys are other appropriate information prior to boarding the ship. The walk from the check-in area to the embarkation ramps should be lined with Duty Free shopping for cruise passengers. For the longer stretches from the passenger processing area, to the boarding gates of the ships, moving walkways should be used to expedite passenger travel between concourses. Furthermore, the concourse does not need

to extend the length of the ship, only to appropriate loading areas. This allows for multiple aerial gangways to accommodate numerous passengers and changing tide levels. The overall goal of this terminal design is to load and unload the ship as rapidly as possible to minimize ship turn around time.

When the ship returns, the second phase of the terminal is tested. Passengers utilize multiple aerial gangways to exit the ship, but are immediately relocated to the first

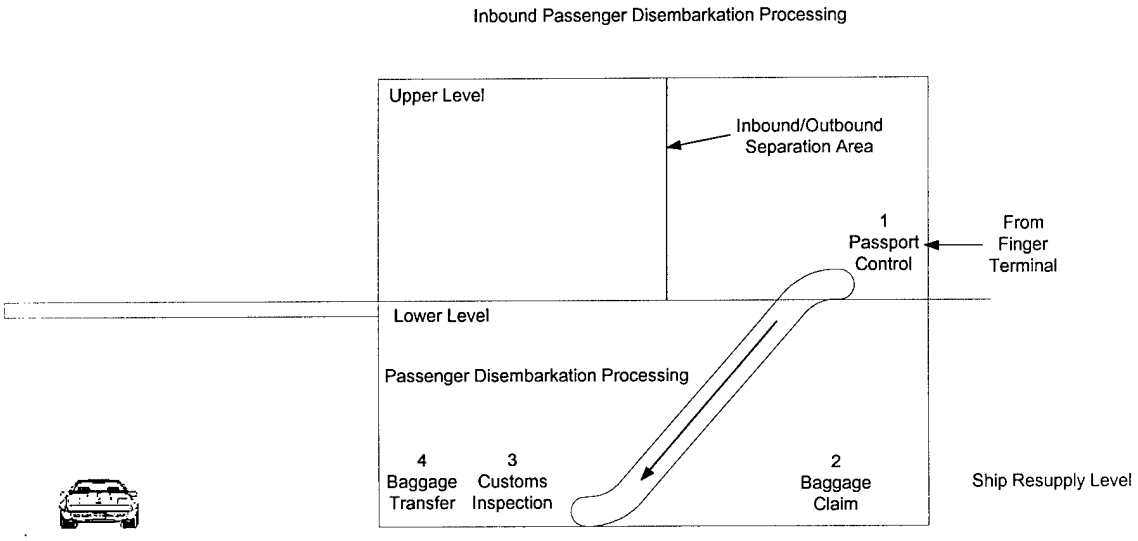
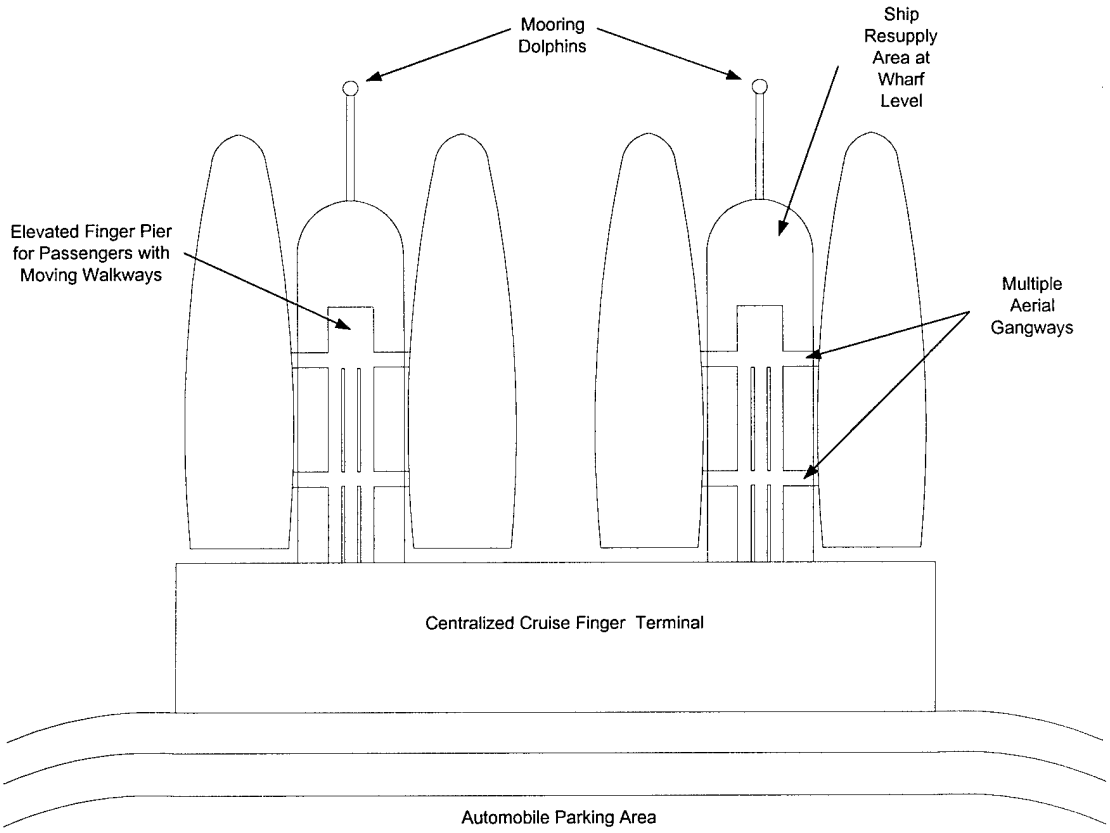


Figure 3.A.2.9 Multilevel Centralized Inbound Passenger Processing Concept

floor of the intramodal terminal for outbound passenger processing. This concept is called vertical separation which has been used very effectively in airport design, but has yet to be fully implemented in cruise ship terminal design. The first stop is the Federal Inspection Station, which is adequately staffed and has the appropriate infrastructure to handle the number of passengers expected to arrive from the ship. Once processed through Immigration and Naturalization Service (INS), the passengers are relocated to the lower level to pick up their baggage at a centralized baggage claim location, then out

process through U.S. Customs. The passengers are then at the curb on the ground level and ready to board outbound ground transportation to continue their journey home.

This centralized cruise finger terminal has five significant advantages over existing systems currently utilized to process passengers. They are rapid turn around times to load passengers and ship supplies, comfort of the passengers, optimized utilization of berth space, potential for future expansion, and optimized use of the FIS



facilities and

Figure 3.A.2.10 Centralized Finger Terminal Conceptual Drawing

personnel. For this concept to work most effectively, these advantages must be exploited to the fullest. The overall goal is to process two mega-ships for each berth in one typical

day in port. That would allow a total of four ships to process daily at one centralized cruise finger terminal. This is a novel concept that has not been fully embraced, but can be accomplished given the right accommodations. The weak link in the cruise system is moving the passengers and their baggage on and off the ship. But with four or more inbound and outbound gangways, baggage conveyors and the vertical separation of incoming and outgoing passengers within the terminal building, this goal could be easily achieved.

Here is a sample of the time schedule a ship would have to meet to accomplish this goal.

Table 3.A.2.2 Time Schedule of Events

Event	Time
Ship 1 arrives at berth	0500
Baggage unloaded	0530
U.S. Customs inspection of baggage	0530 – 0730
Reloading of ship supplies	0800 – 1000
Debarkation of passengers and inspection	0800 – 1000
Ship cleaning	0800 – 1300
Embarkation of new passengers and baggage	1000 – 1300
Ship 1 departs berth	1400
Ship 2 arrives at berth	1500
Baggage unloaded	1530
U.S. Customs inspection of baggage	1530 – 1730
Reloading of ship supplies	1800 – 2000
Debarkation of passengers and inspection	1800 – 2000
Ship cleaning	1800 – 2300
Embarkation of new passengers and baggage	2000 – 2300
Ship 2 departs berth	2400

This arrangement allows for a significant savings in manpower, full use of the facility and requires a fully staffed Federal Inspection Station.

Given the changing trend in cargo shipping from building costly new ports, and the refocused emphasis on maximizing throughput at existing ports, a similar trend can be expected in the cruise industry. The best example is the mega-ships having been delivered over the past few years. This type of system will be the trend, especially for high use origination ports with growing demand in both cruise and cargo traffic, limited space for expansion, and fiscal requirements to get the most out of their facilities.

(ii.) Multi-Use Port Terminal

A Multi-Use port terminal is one that can handle many different functions, and is not dedicated to one singular function. One day the terminal can be used as a location to break down cargo, while on the following day it can be used as a location to load passengers onto cruise ships and used for a meeting location later in the week. These structures are typically located along the length of the ship berth and due to their multi-use nature, need full length access to the ship. They consist of a large warehouse type building that can be easily and quickly adapted to handle the above functions. In most cases these structures are two-story with the enclosed lower level reserved for cargo breakdown when cargo ships are at the berth and cabin assignments and baggage processing when cruise ships are berthed.

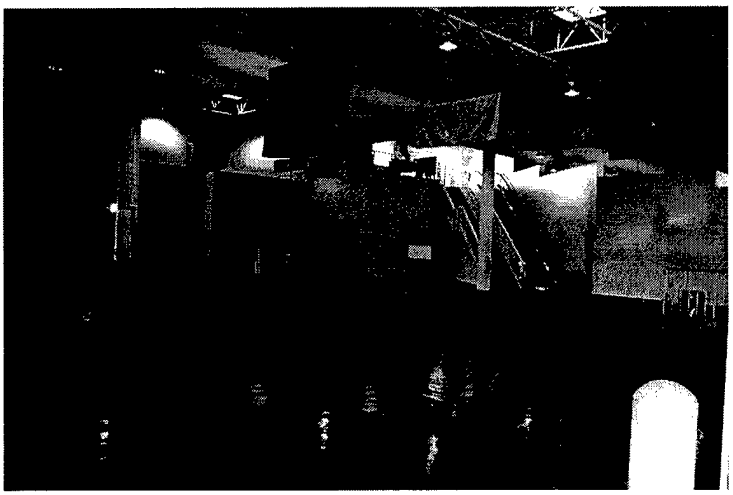


Figure 3.A.2.11 Multi-Use Terminal

After cabin assignments and baggage processing, the passengers move through an elevator or escalator to the upper level. This area acts as a passenger transit point from

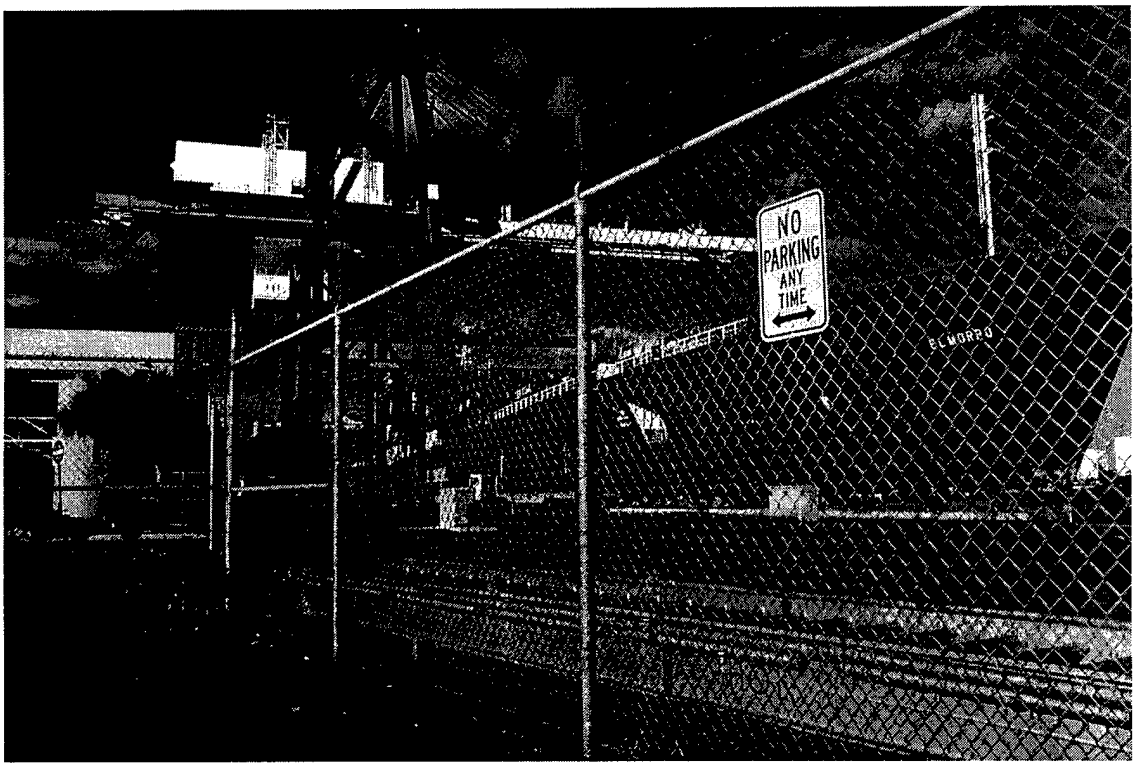


Figure 3.A.2.12 Multi-Use Terminal with Cargo Operations Ongoing

the terminal through an aerial gangway to the cruise ship. This allows for the bare minimum of an enclosed cargo area, a cruise ship passenger processing area, with ground level access for ship re-supply while passengers are loaded through the aerial gangway. The multi-use facility can be carried a step further by developing the highly valuable property. Development may go beyond two floors, and consideration should be given to office space for the cruise lines, cargo lines, waiting rooms, conference centers, or restaurants or any other organization desiring a location close to the water for business reasons. Although these multi-use terminals may be developed beyond two-stories,

consideration should be given to account for the interaction of the terminal structure and the operation of cranes for the cargo portion of the multi-use facility.

In keeping with the greater passenger demand associated with a multi-use facility, consideration should be given to parking space. With a better understanding of the building size and type, the next important consideration is the distance between the building and the edge of the berth. A balance must be struck so the area is wide enough to support crane operations for cargo and narrow enough so that passengers can easily transit the area in an aerial gangway. Furthermore, locations must be made available at the berth for storage of the crane while a cruise ship uses the berth and aerial gangway while a cargo ship utilizes the berth.

The advantages of the multi-use facility are many, especially in smaller ports that are financially challenged and don't have the cruise ship traffic required to support a dedicated cruise ship terminal. This type of design does have its tradeoffs and disadvantages. The multi-use terminal can only be used to support cruise ship and break bulk cargo operations. This type of facility is ineffective for bulk cargo and containerized cargo, which are the cargo handling methods of choice. It cannot support multiple ships in a single day, due to the slower loading process. It consumes a great deal of berth frontage due to the multi-use nature of the berth.

(iii.) Gangways

The gangway entering the ship can be either at the dock level or elevated. At dock level, the gangway shares the operating surface with ship resupply activities and other forms of traffic. This typically limits access to the ship to accommodate the ongoing re-supply operation. Elevated gangways are vertically separated from the

working dock area. This allows for unlimited access to accommodate ship resupply and develops a traffic flow pattern to rapidly load ship stores and baggage. In an idealized scenario, passengers loading and unloading the ship would enter/exit the ship at different levels. This vertical separation would greatly enhance the centralized finger terminal operation. The terminal should be arranged to allow for this type of flow for departing passengers and for arriving passengers. This is similar to airline operations, only more intensive over a shorter timeframe. The typical minimum gangway width for pier side boarding is four feet whereas, the minimum aerial gangway width is five feet. This allows for easier boarding of handicapped passengers.

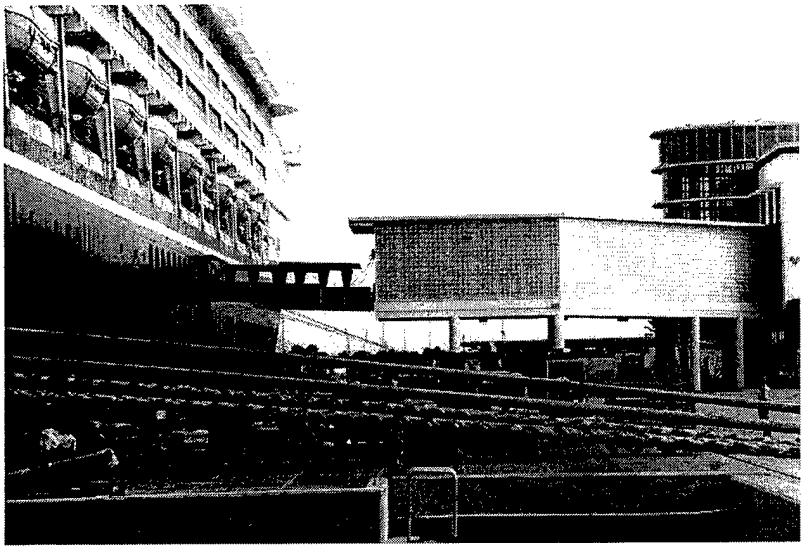


Figure 3.A.2.13 Aerial Gangway

Type	Passengers per hour
Origination Port – Gangway	450
Destination Port - Gangway	450
Origination Port – Aerial Gangway	600
Destination Port – Aerial Gangway	600
Destination Port Tender Operations	300
Pax Staying aboard – wharf ops.	15-25%
Pax Staying aboard – tender ops.	30-40%

Table 3.A.2.3 Estimates of Passenger Movement On and Off Ship

These values in Table 3.A.2.3 can be used for planning purposes to determine the number and types of gangways required as well as for cost comparisons of gangways and ship berths versus tender operations into a port. Use of these planning values could be a significant factor associated with the economic development of a smaller destination port. Special emphasis will be given to tender operations later in the destination ports section.

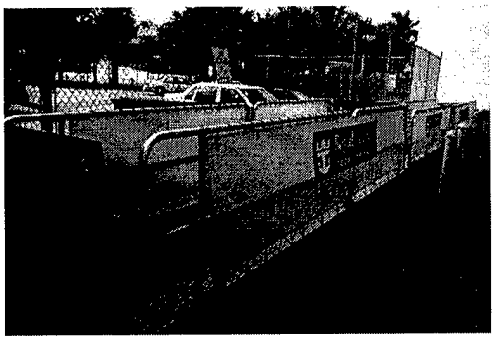


Figure 3.A.2.14 Typical Gangway

Large ports need a mix of dedicated centralized cruise terminal finger pier and multi-use facilities. This allows for rapid turn around of the large dedicated cruise ships, but still gives adequate facilities for the smaller cruise ship operations that are not financially viable to justify their own dedicated facility. This also allows for permanent location of a Federal Inspection Station, which is crucial for continued expansion of cruise ship operations. Furthermore, passengers can be more thoroughly inspected, greatly increasing security of the port and the city surrounding it.

3. Hotel Accommodations and Excursions

As a rule of thumb, between 20 and 25% of homeport passengers stay over for either pre cruise or post cruise vacations (Bermello, Ajamil & Partners, *Ports of Aruba Master Plan*, May 1996). These stays typically range from 1 to 7 nights. The cruise industry recognizes this and has packages of land tours and/or hotel stays combined with cruises. In many cases, this can be a greater revenue generator than the cruise itself, but the cruise is what attracts the tourist to the location. Once at the location, hotels and activities must be sufficiently plentiful and entertaining to ensure the passengers are satisfied.

(a). Hotel Accommodations

Realizing that 20 to 25% of homeport passengers stay over for either pre or post cruise vacation gets the attention of the cruise lines. The potential for additional revenue is significant. The cruise line may receive a percentage of the revenue generated from hotel stays and passenger paid transportation charges from the ship to the hotels. "There is no such thing as a free lunch" and the cruise lines charge for each additional service provided. For logistical reasons, the cruise lines desire to centralize the location of their passengers in as few hotels as possible. This facilitates the transportation of the passengers to the ship and at the end of the

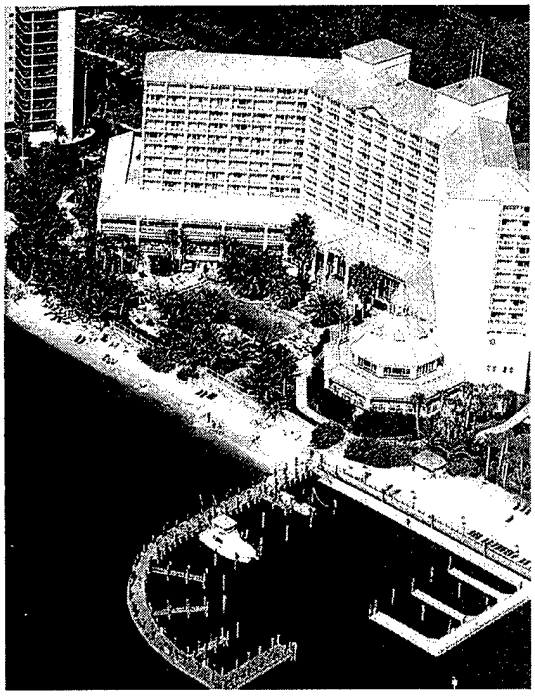


Figure 3.A.3.1 Hotel Accommodations

cruise from the ship to the hotel. Furthermore, it minimizes the number of hotels the cruise line has to interact with and ensures maximum occupancy for ship to hotel bus shuttles. To assess the potential availability of hotel accommodations for homeporting operations, a comparison of existing and planned hotel room inventories against forecasted average room occupancy rates must be made to determine the daily average number of rooms that may be available for cruise passengers. In some cases, additional hotel space may be required, or the quality of hotels may be insufficient to support the cruise operation. In these cases, further development of the hotel infrastructure may be required to consider homeporting operations. The following tables and example are good estimation methods for determining the capacity of hotel infrastructure.

Figure 3.A.3.1 Example Hotel Inventory Listing

Property Type and Name	Market Type	Total Rooms	% of Total Rooms
Hotels			
Hotel XYZ	5 Star	273	3.4
Hotel PDQ	5 Star	283	3.5
Hotel High Quality	5 Star	305	3.8
Hotel Tip Top	5 Star	302	3.8
Hotel Outrageous	5 Star	347	4.3
Hotel Premium	5 Star	340	4.3
Total 5 Star Hotels		1850	23.1
Hotel USA		500	6.3
Hotel FLA		565	7.0
Hotel MIA		527	6.6
Hotel HAY		409	5.1
Hotel ORD		502	6.3
Hotel FFL		396	5.0
Hotel ABC		454	5.6
Total Hotels		3353	41.9
Time Shares			
XYZ Holding		637	8.0
123 Holdings		729	9.2
QRS Holdings		787	9.7
Total Time Shares		2153	26.9
Condominiums			
Condo Americana		96	1.2
Condo Florida		105	1.3
Condo Unlimited		87	1.1
Condo United		87	1.1
Total Condominiums		375	4.7
Total Guesthouse (Rooms)		275	3.4
Grand Total		7988	100%

The total number of rooms from each location/type of accommodation, is then associated with an average occupancy rate and what results is a daily average number of rooms available. From this, the number or weekly passengers that can be accommodated

is determined in either a week-long situation or a three/four day accommodation. The table below is useful in determining the available rooms for passengers.

Table 3.A.3.2 Example Hotel Occupancy Percentages and Room/Occupancy Availability

				Number of Weekly Passengers Accommodated	
Location/Type	Total Capacity	Average Occupancy % Provided by Inn Keepers	Daily Average Number Rooms Available	3-Night Pre or 4-Night Post Cruise Stayover*	7-Night Pre or 7-Night Post Cruise Stayover**
Hotel					
5-Star Rooms	1,850	90	185	740	370
Other Rooms	3,353	83	570	2,280	1,140
Total Rooms	5,203		755	3,020	1,510
Time-Share	2,135	87	277	1,108	554
Condominiums	375	85	56	224	112
Guesthouses	275	80	55	220	110
Grand Totals	7,988		1,143	4,572	2,286

*Assumes double occupancy and room occupied on a rotating 3 and 4 day schedule
**Assumes double occupancy

What must also be taken into consideration is the spread of the accommodations. For example, the cruise line interested in this port may want to concentrate the passengers for pre/post cruise stay-overs in facilities with the greatest availability to minimize logistical problems when transferring to/from the ship. Consideration should also be given to the quality of the accommodations. Some of the more premium cruise lines may only consider the 5-Star accommodations as acceptable for their guests. Once in their pre/post cruise accommodations, most guests are very interested in what the port city has to offer. This is where the excursion availability becomes a key issue

(b.) Excursion Availability

While staying over in the vicinity of the origination port, passengers are usually in search of activities to entertain them during their stay. These activities can range from the nightlife of the city, shopping excursions, enjoying the beach, Self Contained Underwater Breathing Apparatus (SCUBA) diving, deep-sea fishing, or expanding personal knowledge through trips to museums or sight seeing historical sites. The key is that the origination port city needs to have enough diversity in attractions to keep tourists actively involved and interested in the destination.

Figure 3.A.3.2 SCUBA Diving

Origination ports need to develop attractions that will keep the tourists entertained. Disney has accomplished this through their theme park in Orlando and linking it with their theme ships based out of Port Canaveral. Disney is recognized as a worldwide attraction, but not all origination ports and their cruise lines have that "name" draw. They need to develop a niche in the market that helps set them apart as a unique tourist destination. This will keep tourists interested in the location and spur their desire to return for future vacations.

Figure 3.A.3.3 The Coliseum in Rome

The chamber of commerce, cruise lines and hoteliers should work closely together to further enhance the tourism capacity and level of service for the vacationer. It is their collective best interest to communicate effectively and be well aware of actions affecting the entire community. If they are well integrated, they will be highly successful in promoting the community and the cruise industry originating from the community.

Figure 3.A.3.4 Disney World, Florida's Largest Tourist Attraction Shares a Cruise Line

4. Ship's Physical Characteristics

The first issue examined by the most casual observer is, will the length of the ship fit in the port? This is a valid concern and must be addressed. In addition to the length, the beam (width) and the draft (required operating water depth) of the ship must also be considered. In addition to these factors, the displacement of the ship must also be considered to ensure the mooring points are adequately spaced and sized. to support the loads imposed by the ship. A listing of these ship characteristics for numerous active cruise ships are summarized in Appendix A.

(a.) Ship Draft

Generally, most ports were originally constructed for cargo ship traffic, especially those ports that have adequate infrastructure to be considered sufficient for a cruise ship origination port. Since cargo ships generally have a greater draft requirement, this means that cruise ships can easily operate in their waters with respect to draft. After examining the draft requirements for over 100 modern (constructed in the last 35 years) active cruise ships, it can safely be said that a draft of 28 feet is the maximum required by 99% of cruise ships. The one exception is the Queen Elizabeth 2 with a draft approaching 33 feet. (http://www.seaview.co.uk/cruise_ships.html, visited October 2000 and http://www.cruises-by-net.com visited October 2000).

(b.) Breakwaters

Another consideration is the ship length versus port breakwater opening. The breakwater opening is designed based on the size of ships using the port. The breakwater opening size is a balance of several factors. Ideally, the size would be small, only accommodating the maximum size ship as it transits the port. This would minimize the

wave action entering the port through the port entrance. But nothing is ideal, especially when "mother nature" is involved. The port opening requires extra width to allow for drift of the ship as it encounters crosswinds entering and exiting the port. Additionally, the width of the breakwater opening grows to allow for the draft requirements of ships. The draft requirements are driven by the ships with the greatest draft using the port, typically cargo ships. Once that draft is determined, a side slope from the bottom of the port entrance to the water surface is applied. For example the draft requirement may be 40 feet. Applying a 3 to 1 side slope on each side of the entrance channel would add (40 feet x 3) = 120 feet to each side of the channel for a total of 240 feet over the desired minimum channel width.

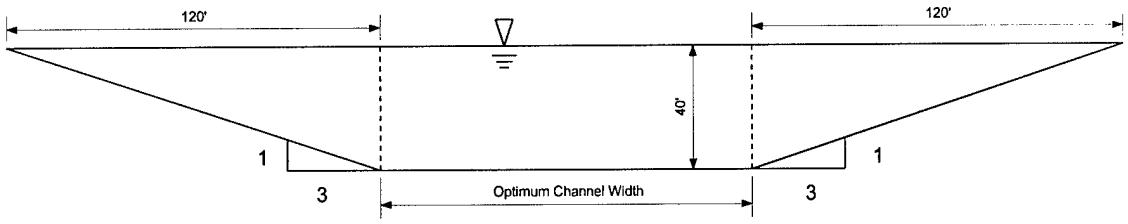


Figure 3.A.4.1 Example Port Entrance Channel Cross Section

Lastly, the influence of multiple ships using the channel must be considered. This usually is not a factor for ports large enough to receive ships, but the volume of traffic is an issue for small craft harbors. As a guideline, using the values of 300 feet for a small harbor, 400 to 500 feet for a medium harbor and 500 to 800 feet for a large harbor have proven sufficient (DeF. Quinn, 1972).

(c.) Ship Propulsion Advances

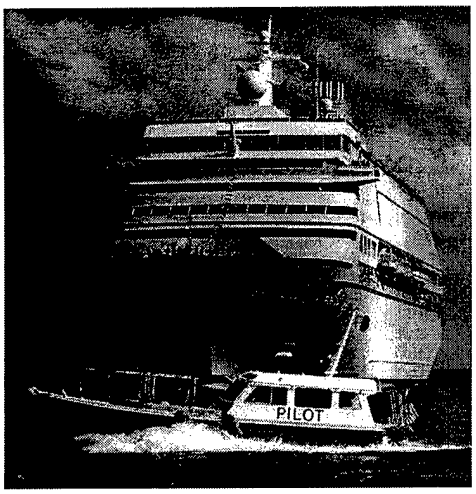


Figure 3.A.4.2 Pilot Boat

Two tremendous assets in assisting with ship operations as they arrive into the port are the harbor master and the pilot. The harbor master directs the flow of large ship traffic within the port and controls berth access. They control the seaport and are usually positioned in a position with an unobstructed view of the entire port, much like an air traffic controller. The pilot is a person who specializes in hydrodynamic properties specific to the port they work at. They are intimately familiar with the port and are tasked with meeting incoming ships at sea, boarding them, and providing the Ship's Captain with advice on getting their ship through the port and into their assigned berth. This is a crucial job essential to the safety of the port, passengers, cargo, crew and environment. They are positioned in an area with adequate docking space for their boarding craft and land side crew accommodations. The arduous task of maneuvering the ship into the port and to the berth is also coordinated with tugboats. They provide additional propulsion at key locations on the ship's surface to berth the ship. This system of pilot and tugboats is starting to change.

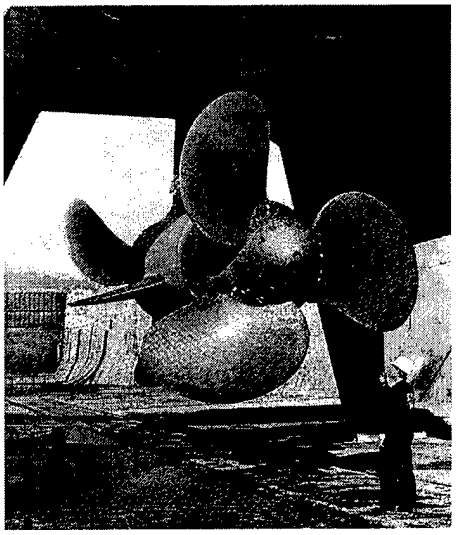


Figure 3.A.4.3 Azimuthing Pod

Recent advances in cruise ship propulsion include bow thrusters and azimuthing pods at the stern of the ship. These types of propulsion make the

ship more maneuverable and easier to control. This results in accident avoidance and allows for smaller factors of safety and more closely engineered ships. These propulsion advances do not come without cost. The vectored thrust they provide increases scour around the base of pier walls. This may have long-term negative impacts on the type of wharf walls currently in use. New construction and wharf rehabilitation should account for this vectored thrust and attempt to minimize the negative impact of scour on the wharf wall. Furthermore, additional research should be undertaken to discover remediation techniques to treat wharf walls that are suffering from settlement problems relating to scour.

(d.) Mooring and Fender Spacing for Cruise Ships

Review of existing mooring and fender spacing conditions at several ports revealed an overabundance of mooring locations for ships. For example, the moorings and fenders were spaced at sixty-eight foot intervals at the Port of Miami in the cruise ship area. Although this may seem excessive, it does allow for minor adjustments in ship location at the berth and the berthing of a wide variety of ship sizes and types. This type of spacing is very reasonable for the most flexible use of the berth. In the instance of a single ship solely occupying the berth, and otherwise remaining empty, a specialized mooring system may be utilized. This system may have a series of fender spacing and moorings that coincide with the ship size and load

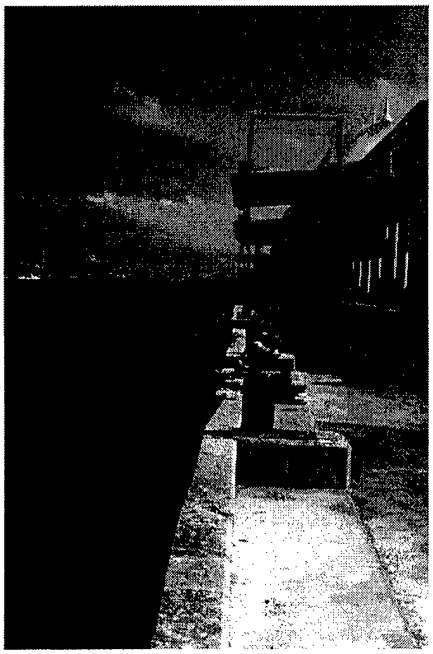


Figure 3.A.4.4 Fendering Systems

requirements. This is an idealized situation and does not account for the multi-use of the berth. It also does not allow for expansion of the berth to meet the ever changing needs of maritime use. Therefore, using a standardized spacing for moorings and fenders makes a great deal of sense. Another design feature that makes sense is a fendering system that leaves a standardized space between the ship and the bulkhead. The standardized space in South Florida is four feet, which prevents marine mammals from being caught between the bulkhead and the ship and compressed. This spacing also prevents people who fall in the water from the same fate. Overall, this appears to be a great safety feature.

5. Ship Utility Requirements

The utility requirements of a ship are unique and will be growing as environmental controls continue to be tightened. Major utility considerations are supply of fresh water, removal of waste water, shore provided electricity, fueling requirements, disposal of waste and/or bilge oil, other hazardous waste disposal and communications.

(a.) Potable Water

Potable water (water that is safe to drink) is used aboard ship for a variety of things. This water can be used for consumption, cooking and cleaning. The generally accepted standard for water consumption per person is set at 100 gallons per person per day. This would include crew and passengers and takes into an average consumption per person with regard to all aspects of daily life. Given the ship information provided in Appendix A, and this factor, a reasonable estimation of ship requirements, while in port can easily be made. This value provided does not take into consideration any reverse osmosis capacity the ship may have to manufacture potable water on board, or situation where sea water is utilized instead of potable water.

(b.) Shore Power

In the past, all ships used their engines to provide power while in port. In an unprecedented move in the cruise ship industry, Princess Cruises offered to turn off their electrical systems and plug into local power grids during port calls in Juneau Alaska. This announcement was made amid an Alaskan government crackdown on cruise ships in Alaskan waters for allegedly polluting the air. Princess volunteered to invest several million dollars to design and build equipment to allow its ships to run on board services from power supplied by Alaska Electric Light and Power Company. In August, 2000, the

United States Environmental Protection Agency recommended fines of $110,000 against Princess Cruises and $55,000 against Norwegian Cruise Lines for allegedly exceeding limits on smokestack emissions. Furthermore, Alaskan officials issued notices of violations to seven cruise lines. Even though Princess Cruises demonstrated their commitment to protecting the environment, they still are negotiating with the EPA over the validity of the emissions readings and the fine associated with the readings. (Sun Sentinel, Oct 15, 2000) Although this is a simple case study, it has a direct bearing on the design of ports to support cruise ship operations. Providing power to the ports is a significant aspect of infrastructure development that may need further future consideration.

(c.) Sanitary Wastewater Treatment

Current maritime practice for the disposal of wastewater at sea is simple. At different distances from shore, varying items can be disposed of at sea without treatment. This is a generally accepted practice that will probably see a sharp decline in the future, and is highlighted by anti-cruise organizations promoting cruise ships as floating polluters of the ocean. The treatment method for this type of "pumping out" follows the theme of an old waste water treatment plant operators "the solution to pollution is dilution" The problem is that with upwards of 3,000 passengers and crew per ship, the solution is no longer adequate and the pollution needs to be dealt with in a different manner. Either the wastewater must be treated aboard ship or retained on the ship until it can be transferred for land-based treatment. This will avoid the environmentally costly practice of ocean dumping. Accommodation for land based treatment are not yet available at most cruise ship ports as they would put a tremendous spike on the inflow of

wastewater treatment plants. However, planning should begin for such capacity within new plant design and at the ports that accommodate ships. Given the 100 gallons per person per day standard for potable water supply, a similar number can be used for wastewater manufactured. Thus, given the information in Appendix A, a value can be arrived at for the quantity of wastewater requiring treatment on a daily basis.

(d.) Hazardous Waste Handling

Hazardous wastes are handled aboard ship, and are generally disposed of by contractors specializing in this type of waste disposal at the cruise origination port. Such wastes may include dry cleaning byproduct, and waste oil from the bilge area. Illegal discharge of bilge oil is in violation of the Clean Water Act. In the past, cruise lines have been fined for violating this Act. Most notably in the 27 million dollar fine imposed on Royal Caribbean Cruise Lines for violating the Clean Water Act and lying to the United States Coast Guard. (Stieghorst, Oct 17, 2000).

(e.) Communications

The latest trend for ship to shore communication while in port is the use of infrared connections while at the berth. This type of system has numerous advantages over older cable systems. Since a mechanical connection does not exist, connectors can't corrode and fail. The lack of mechanical connectors makes the system universal, allowing multiple ships to use the system without fear of different connector types. The only requirement of this type of system is a clear line of sight between the receiver and transmitter. Land side receivers/transmitters should be located to maximize utilization without line of site disruption. The increased use of the Internet as a global communication system, information and recreation source will increase demand by

passengers while aboard ship. The infrared system can be utilized while in port, but satellite systems are the only choice while at sea. This demand of ship board satellite systems for communication will continue to increase and eventually, computer lines into each cabin will be the norm.

(f.) Fueling

Ship fuel is generally provided by one of two means. It is either delivered to the ship via land or water. By way of land, the fuel may arrive through hard lines piped into the pier structure, or pumped aboard by delivery truck. The other proven method is via water by fuel barge. Generally, delivery by hard lines or water is accepted for cruise ship operations because it minimizes land-based traffic, which is at a premium to re-supply the ship and load passengers. Furthermore, one fuel barge can typically accommodate the fuel requirement for the ship whereas it may take several fuel trucks to meet the ship's demand. But at the same time, it risks oil spills into the sensitive seaport environment.

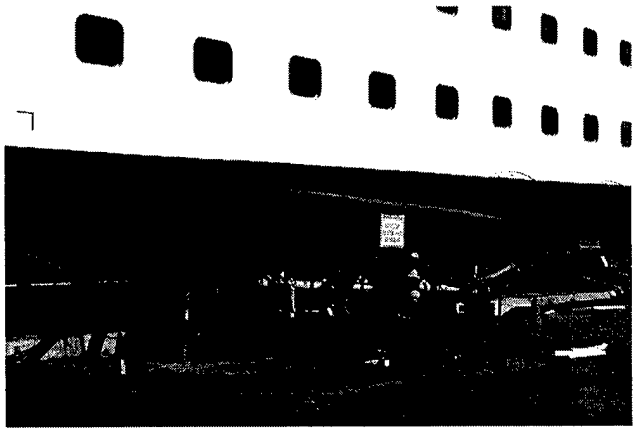


Figure 3.A.5.1 Land Side Fuel Delivery

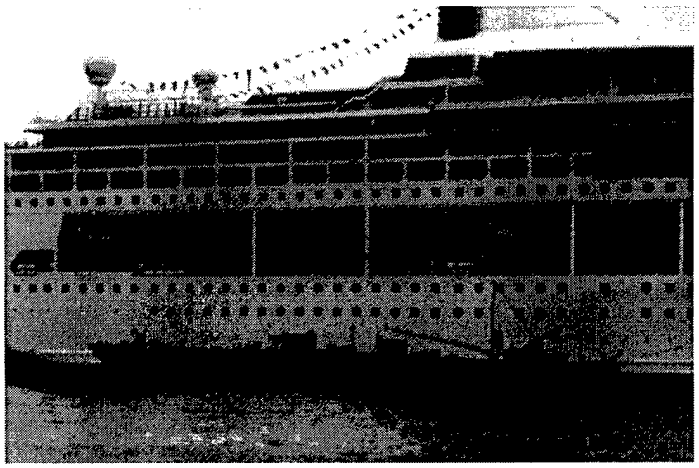


Figure 3.A.5.2 Fuel Deliver Via Barge

6. Ship Support Services

For port planning purposes, the ship support services are primarily associated with delivery of materials to the ship while in port. This includes food and beverage delivery for the food services side of the ship operation and hotel and house keeping items for the accommodations side of the ship operation. The key to success for the ship support services is having an adequately sized delivery area that is secure. The delivery area should be wide enough to allow cargo trucks to unload their goods by forklift, and then loaded directly to ship by the same forklift. Since several different deliveries may take place, delivery traffic must be able to flow through the area. This is the area along the bulkhead, between the terminal and the ship. This delivery corridor is one of the key reasons for the aerial gangways and vertical separation of the passengers and the delivery operation. This delivery area must also be secure. All unauthorized personnel should be kept out of these areas for the sake of security and safety. Lastly, to expedite the process, land side vendors bundle smaller goods together into forklift sized quantities to simplify handling and minimize the loading time onto the ship.

Figure 3.A.6.1 Ship Resupply

7. Port Support Services

Other topics of interest, pertinent to the success of the port must be taken into consideration for planning purposes. They are the security of the port, the marketing and promotion of the port, the fees and charges associated with port usage, and the fire rescue/EMS services provided by the port.

(a.) Port Security

Port security is an issue making its way to the headlines of news reports on almost a daily basis. In South Florida, the primary port security issue is smuggling. Smuggling is a broad term including drugs, automobiles, consumable merchandise and people. This same activity is a concern in many ports around the world. The key to controlling this problem is minimizing access to the ports and the ships berthing in these ports. Another major port security issue is terrorism, like that evidenced against the USS Cole while berthing and refueling in Yemen. Although military targets are sought out by terrorists, cruise ships have been targeted in the past, and would definitely grab the headlines, the primary objectives of terrorists. A recent concern with regard to port security is environmental contamination. The pump out of ship's water ballast tanks has resulted in foreign water borne species being inadvertently imported to the home waters of South Florida. These unexpected arrivals, a Pacific jellyfish, have been traced to the death of many endangered turtles that feed on jellyfish.

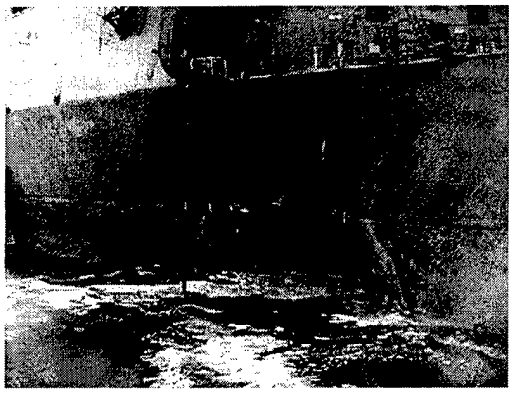


Figure 3.A.7.1 USS Cole Attack

(b.) Port Marketing and Promotion

Origination ports are marketed and promoted by the cruise lines. The infrastructure of the ports and their surrounding transportation systems provide what the cruise lines need to get the passengers to and from the ships. With provisions made for the passengers and the ships, the next most important feature of origination ports is the geographic location of the port. The closer the origination port is to the destination ports, the shorter the travel distance, and the lower the fuel charges to move the ship. In the United States, another limitation exists, the Passenger Vessel Service Act (PVSA). Basically, this Act requires that ships making sequential visits to U.S. ports be crewed with American citizens, built in the United States and fly the American flag. Almost all cruise ships have international crews, are constructed in Europe or Asia, and fly under various flags. This limitation has resulted in very few U.S. destination ports. But due to the infrastructure requirements, many origination ports exist within the United States. These typically service the cruise markets from Southern California to Mexico, Florida to the Caribbean, and Pacific Northwest to Canada and Alaska. This type of self-imposed embargo does not exist in any other country in the world and totally goes against the United States belief in free enterprise.

(c.) Port Usage Fees and Charges

The cost of port usage fees and other charges must be competitive to attract cruise lines into the port. As mentioned earlier, some ports even pay to have passengers delivered to them. Other ports have features that make them attractive to the cruise lines. Some ports have lower costs for fuel, and the ship may make a weekly stop to refuel. Water is another concern. South Florida has long been known as an inexpensive place to

take on potable water for the ship. Costs for water in Port Everglades are roughly one dollar per ton whereas cost approach seven dollars in New York. Cruise lines will be drawn to ports with lower fees and ease of access. To make the port attractive, fees must be scrutinized and remain attractive to the cruise lines, while simultaneously providing enough revenue to sustain port operations.

(d.) Fire Rescue / EMS

Seaports can vary in size, and some ports with a larger geographic area may require specialized fire rescue and/or Emergency Medical Services (EMS). These operations focuses on two different environments, the land side and the water side. The land side operation can be addressed with typical industrial area emergency response equipment. Given the industrial nature of most ports, this type of "worst case scenario" preparedness is best suited to most ports. In ports with limited or disrupted land access, additional consideration should be given to ensure adequate emergency response.

Figure 3.A.7.2 Port Everglades Public Safety Building

For example, a port relies on land-side emergency services provided by the city on the mainland. A drawbridge connects the port and the mainland. For this case, the bridge was stuck in the up position and a fire and/or other life-threatening emergency occurred,

how would this emergency be dealt with? The emergency services have been rendered useless. This stresses the importance of access to the port. Emergency services within the port should be adequately sized and staffed to service an industrial area with additional manning to accommodate the additional tourists on days the cruise ships are in ports. Another consideration is the cruise ship hospital. These facilities are increasingly self reliant and suitable for emergency situations, a valuable resource that should not be overlooked.

The water-side response for fire rescue is very specialized and well beyond the scope of this report. This usually involves fire suppression boats, tugboats and/or aerial rescue or medical evacuation to land based hospital facilities.

8. Homeport Expansion Considerations

The expansion of homeport operations, is a multi-stepped process spanning all considerations of an origination port operation. The first step is to determine growth goals for the port. This should be accomplished using realistic expectations taking into consideration numerous economic considerations that incorporate all aspects of the cruise ship industry. This type of forecasting is well beyond the scope of this research. Expansion of cruise origination port operations is an all-encompassing event that requires the coordination of numerous agencies for effective implementation. Once the growth goals have been established, a close look must be given to connecting transportation.

Connecting transportation includes, air, rail and automobile. The proximity of these modes of transportation to the port is crucial and the ability of these systems to expand is essential to growth of the cruise origination port. Evaluation of existing land based transportation requirements, per the previous example should be compared with growth goals to ensure adequate land based transportation. A similar evaluation should be made with respect to airline arrival flights. In some instances, the airlines may need to add flights to accommodate additional cruise travelers. The impact on airlines can be significant, for example, cruise travelers flying through Miami International Airport, the 12th largest airport in the world, make up 10% of the airport's total passenger volume. Needless to say, expansion of origination port operations will require coordination with numerous agencies to ensure efficient growth. Agencies involved with transportation issues should include airport officials, local roadway officials, tour bus agencies, port personnel and the cruise lines. In addition to expansion of transportation to the port,

consideration should also be given to land based transportation for excursions before and after the cruise.

With growth, comes the requirement to "entertain" more passengers while in port. This entertainment can be viewed in a variety of ways. It can be retail shopping, site seeing, or just relaxing on the beach. Regardless, all means of entertainment must be enhanced to their fullest and preserved to maximize potential. Retail shopping should be incorporated into a master plan that includes duty free shopping, shopping in trendy areas as well as outlet shopping. Plans should be developed to provide ground transportation between those areas. Some cruise lines are checking-in early arrival passengers onto the ship, then providing off-ship shopping excursions while waiting for the remainder of passengers to board the ship. Another trend is to expand retail facilities at the port, especially duty free sales. Currently, this is not practiced extensively at cruise ports within the United States, but is popular at airports. However, internationally, duty free sales are very well developed at cruise terminals such as Singapore.

In addition to developing the shopping infrastructure, consideration should be given to other areas of interest adjacent to the port. Culturally important, scenic and threatened natural resources of the origination port city and/or country should be saved and highly regarded. Many times, these locations are the tourism draw that keeps vacationers returning for future visits, or pre/post cruise visits. This all means additional tourism revenue for the cruise origination port city.

Having covered the transportation issues and excursions associated with the cruise origination port, consideration should be given to existing hotel accommodations for pre/post cruise stays. Similar to the origination port example, an accommodations

evaluation must be made and compared with required lodging space requirements associated with the projection of additional passengers.

The last physical consideration for the port and the adjacent community is whether the port can handle the additional ship traffic and/or the additional size of new ships. The infrastructure of the port must be sufficient to support the berthing of new/additional ships. This may require berthing additional ships in areas traditionally used for cargo only operations. The terminals associated with these berths may need to be converted into multi-use terminals. Berthing locations may need special modifications to support larger ships. This could entail greater utility capacity, specialized baggage handling systems, or new mooring dolphins to adequately secure the larger ships. All aspects of the ship's operation must be taken into consideration.

Depending on cruise traffic volume, another approach would be development of a cruise only section of the port. This area could specialize in the movement of passengers and other goods associated with cruise operations. This may include a cruise-only terminal with specialized intramodal connections to rapidly and efficiently move passengers and baggage to and from the cruise port location.

The third and simplest approach would be to revise berth schedules to accommodate ships when berths at the port would otherwise be vacant. The possibilities are endless for different expansion scenarios. Whatever approach to accommodate additional/new ships is considered, maximization of existing facilities should be the first priority. This will prevent capital investment of funds toward new facilities or berthing locations until maximum capacity is reached. This methodology will result in the greatest profitability for the port and adjacent city.

With the port's physical considerations and the support functions for the cruise origination port expansion addressed, the final step is to market the port to ensure the additional/new ships are sailing at full capacity. This is usually accomplished by a marketing campaign developed by the cruise lines. In most cases, the cruise origination port is not directly marketed. Instead, cruise lines market the more glamorous destination ports and the adventure of the cruise experience.

B. Cruise Ship Destination Ports

The cruise ship destination port is the reason many vacationers take cruises. They want to see new and unfamiliar places. The adventure, luxury and economy of traveling aboard a ship to these new places, even if only for a few hours adds to the excitement of the vacation. Visiting someplace new and seeing all it has to offer is a thrill. Most cruise passengers visit a destination port for few hours, but these few hours can form a lifetime of opinion about a location. A first impression is a lasting impression and that is why it important for destination ports to put their best foot forward and come across as inviting, friendly and accommodating as possible. This is crucial to attract cruise travelers for return visits, either by cruise, or through more conventional means and good publicity is essential to keep the cruise market strong for first time cruise vacationers.

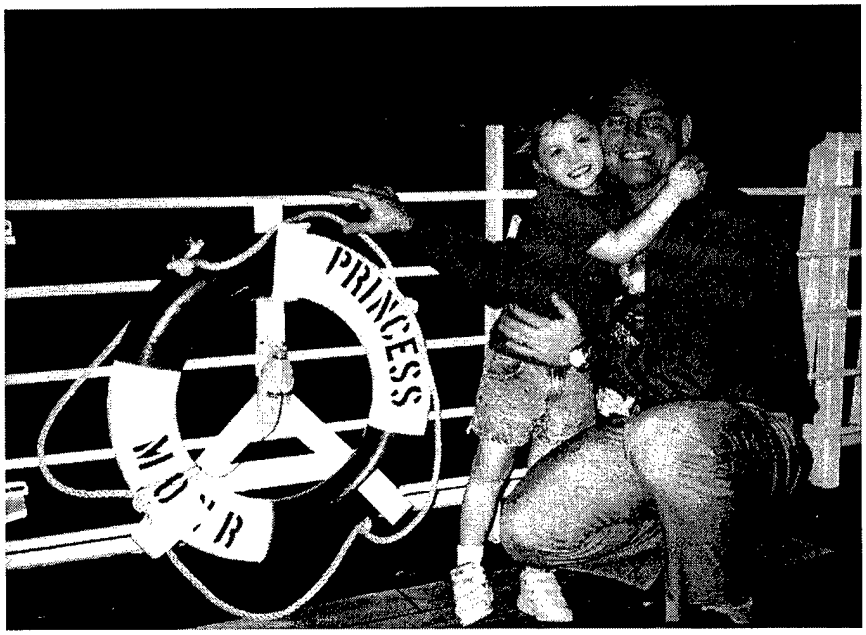


Figure 3.B.1 Cruisers Aboard the Grand Princess

Given the short duration visit for each passenger at the destination port, the cruise ship destination port has a different focus from the origination port. This section will highlight the six areas of interest for a destination port. The first will be physical ship characteristics and how they impact destination ports. The next will be the utility

requirements for ships at destination ports. That follows up with passenger processing requirements on and off the ship. Transportation issues are then covered because once on land, the passengers usually require some type of ground transportation within the port area. If traveling outside the port area, this usually entails some type of excursion or other tourist related activity. Lastly, consideration will be given to expansion of destination ports.

1. Physical Ship Characteristics

Cruise ships physical characteristics become increasingly important at destination ports. The ship's length, width and draft must be considered, in addition to mooring and fender locations. If ports are unable to support the ship, either due to size, or overcrowding, this leads to the use of tenders, or in some cases, the ship by-passing the port. In turn, this results in significant lost revenue for the destination port.

Many destination ports have limited berthing space and the berths that are available may not have adequate draft to support cruise ship operations. As can be seen from Appendix A – Ship Information, most (approximately 99%) of active cruise ships have a draft requirement less than thirty feet. In addition to the berth area having sufficient draft, the port entries must be sufficiently dredged to accommodate these ships. Using thirty feet as a planning factor for cruise ship draft is adequate, but the larger variables are with respect to the length and width of the ship. This length and width of the ship must be accommodated within the port for navigation and berthing. In some instances, the port may have adequate berthing space for a ship, but they have insufficient room for the ship to safely navigate into the port berthing space they will use while at berth. The new Mega-ships highlight this problem. They have draft requirements similar to much smaller ships, but their overall size (length, width and gross tonnage) is too great to be reasonably accommodated at some smaller destination ports.

Key destination ports are sometimes under very high demand, especially in the Caribbean. One such destination port is St. Thomas in the U.S. Virgin Islands. During the winter season, St. Thomas may receive as many as 5-7 ships during peak days. Unfortunately, St. Thomas only has berthing sufficient for three normal to small-sized

cruise ships. What results is cruise passengers utilizing cruise ship tenders to move from the ship to shore at the awaiting land based excursions.

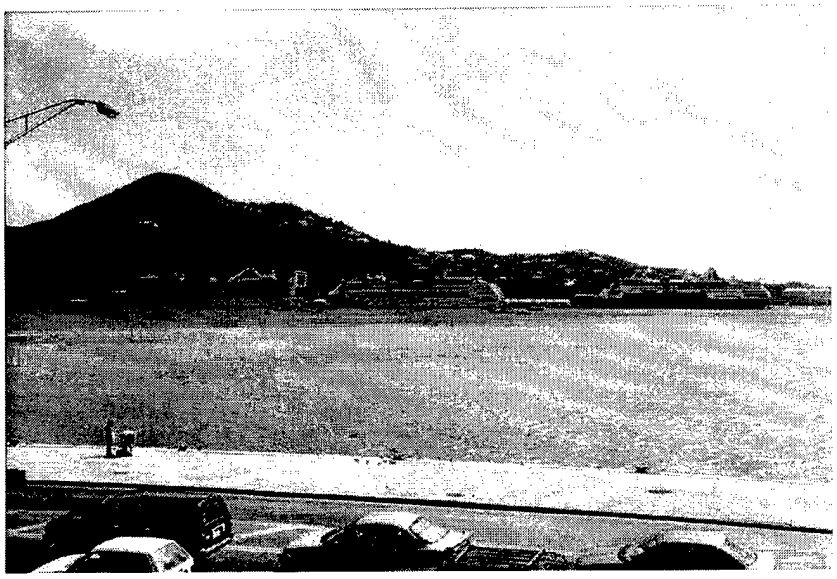


Figure 3.B.1.1 St. Thomas Cruise Port

Some ports, such at St. Maarten don't have room to berth cruise ships at all. In this case, the port has developed a tender fleet. These tenders have a much greater capacity and are faster than the tenders typically lowered from the cruise ship. The result is more passengers getting to and from shore in a quicker manner. While tenders seem like the solution for shortfalls in port berthing, they have many hazards. The likelihood of a slip and fall accident is much higher during tender operations. This usually occurs when passengers embark and disembark the tender at the ship while the ship and tender are moving due wave action while at anchor. This movement can make it hazardous to go ashore, especially for elderly passengers who may

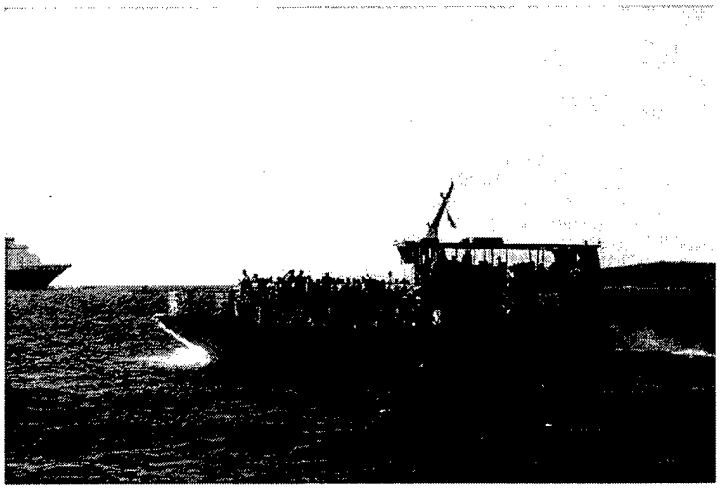


Figure 3.B.1.2 St. Maarten Tender

not be as mobile. In some instances, the waters may be too rough for the tenders to operate, or it results in a very rough ride to and from shore. In these circumstances, the passengers may not be allowed to go ashore, the destination port will not have cruise traffic that day, and the ship may be diverted to a more cruise ship friendly port. Another situation that can occur is when passengers go ashore early in the day, the sea conditions turn rough, and they are temporarily trapped ashore.

Lastly, if tender operations are the only way to overcome shortfalls in berthing space, allowances should be made for likely moorings outside the port entrance. Environmentally sensitive areas should be avoided whilst protected areas with calmer sea conditions to ensure all weather operation should be sought out. A smaller location closer to likely tourist attractions should be utilized as the landside tender berth to better accommodate passengers. This shortens walking distances and allows the passengers to return to the ship in a more timely manner.

2. Utility Requirements

The utility requirements of ships are unique, but fortunately for the smaller destination ports, the cruise ships at berth have the internal capacity to provide all their own utilities. But as environmental controls tighten, major utility considerations may be necessary. Typical utility concerns for cruise ships at origination ports are supply of fresh water, removal of waste water, shore provided electricity, fueling requirements, disposal of waste and/or bilge oil, other hazardous waste disposal and communications. But at destination ports, the requirements differ. Ships currently require no support, but as mentioned earlier, that may change. The areas most likely to change are based around environmental concerns and are with regard to electrical supply (shore power) and disposal of sanitary wastewater.

(a.) Shore Power

Currently, all cruise ships use their generators to provide power while in port. In response to a complaint by the United States Environmental Protection Agency (U.S. E.P.A.), Princess Cruises offered to turn off their ship board electrical production systems and plug into local power grids during port calls in Juneau Alaska. This announcement was made amid an Alaskan government crackdown on cruise ships in Alaskan waters for allegedly polluting the air. Princess volunteered to invest several million dollars to design and build equipment allowing it's ships electrical

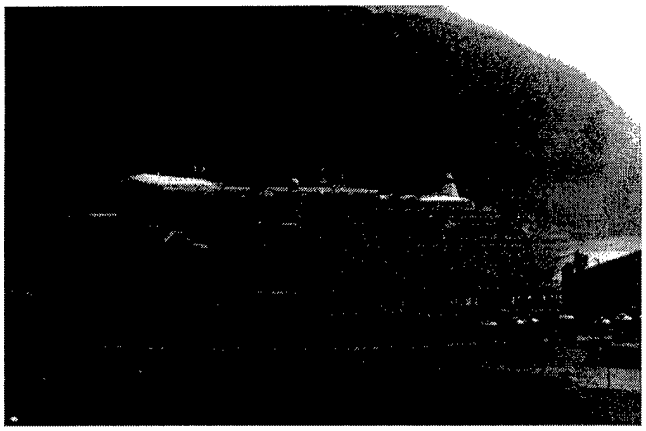


Figure 3.B.2.1 Cruise Ships at Berth in Alaska

systems to run on services supplied by Alaska Electric Light and Power Company. This would eliminate the likelihood of fines that have previously been generated by the U.S.E.P.A. against Princess Cruises and $55,000 against Norwegian Cruise Lines for allegedly exceeding limits on smokestack emissions. (Sun Sentinel, Oct 15, 2000) Development of an electrical distribution system infrastructure adequate to support ship operations while at berth may be costly and uneconomical. But consideration should be given to improving the efficiency of shipboard power plants so they can operate in port, or development of the land based infrastructure. The end solution to this topic may be tricky, but a resolution must be arrived at so environmental considerations are balanced with financial and technological realism.

(b.) Sanitary Wastewater Treatment

Current maritime practice is for disposal of grey water at sea. This means that the waste of 3000 passengers and crew is daily dumped at sea. In the future, public pressure will force the cruise lines to address this problem. Especially as pollution levels increase and global environmental awareness continues to rise. The simple solution is for ships to heavily modify how grey water is handled and treated aboard ship or store grey water for transfer to land-based wastewater treatment. In either case it avoids environmentally costly dumping at sea.

In the event that grey water is treated at land-based facilities, it is fair to believe that destination ports may take on part of the treatment process. Especially given the fact that a 7-day cruise with 3000 passengers and crew members utilizing an average of 100 gallons of water per person would generate roughly 2,100,000 gallons of grey water. That may be more than the cruise line is willing to store aboard ship for transfer at the

origination port. If that is the case, then the grey water will need to be treated at destination ports. To accommodate this, a transfer station may need to be constructed to pump this waste to a centralized treatment area. No doubt this will lead to additional costs for the cruise lines, as they will have to pay fees to transfer this waste.

(c.) Other Utility Concerns

Destination ports may have some other utility concerns, that may or may not be driven around the environment. In some ports, fuel charges are very low and a cruise line may want to take advantage of market prices to minimize costs. In this case, the destination port may have to incorporate fueling into the berthing location.

Another consideration is disposal of hazardous waste. Given the varying worldwide standards for environmental regulation, what results is varying worldwide costs associated with disposal of hazardous waste. This tends to result in hazardous waste disposal in areas where it is not treated properly, but at a reduced cost. For example, the variation in standards associated with ship bottom painting has resulted in more business for boat repair operations based in the Bahamas versus South Florida. The chemicals used in the bottom painting process are considered hazardous waste and environmentally toxic in the United States. But the Bahamas is looser with regard to environmental regulation and this has resulted in a shift of business in this very lucrative field.

3. Passenger Processing

Passenger processing for destination ports is different than origination ports in several distinct ways. The big delays associated with origination ports, baggage handling, ship re-supply and waiting for passengers to arrive via connecting air travel are not factors at the destination ports. The destination ports are simpler with respect to these issues, and only have the requirement to process the passengers on and off the ship. The manner in which this is accomplished usually occurs in one of two ways. Either the entire ship and its passengers are cleared or the passengers are processed individually.

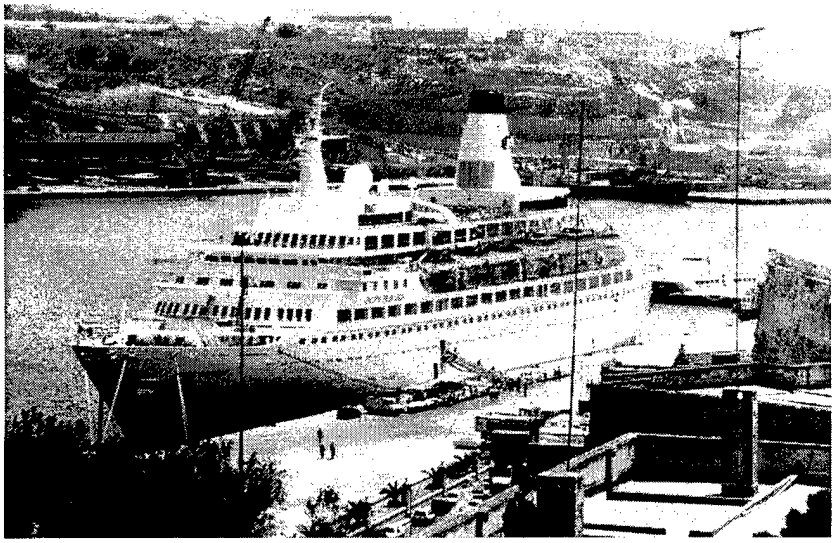


Figure 3.B.3.1 Passenger Processing in Malta

The destination port and local government must make some decisions with regard to how they are willing to allow cruise passengers to leave the ship. They must decide if they want to inspect every passenger, or if they want to clear the entire ship. This decision will drive the infrastructure requirements and the likelihood of the port being used for future cruise ship visitations.

If the destination port opts to inspect every passenger, they will have a traditional customs and immigration, much like that seen at airports, or proposed for the cruise origination port. Processing an estimated 2000 passengers would take a significant amount of time. Given that it takes approximately two minutes to process each

passenger, that results in 4000 minutes to inspect the passengers coming ashore, assuming all come ashore. If the Federal Inspection Station (FIS) operates 40 inspection booths (an unrealistically high number) it would take 100 minutes to accomplish the inspections. At an origination port, this level of inspection can easily be accomplished, because the passenger embarkation and disembarkation are spread out over a greater duration of time. But at the destination port, this would require almost two hours to disembark the ship and process through the FIS, returning later in the day and processing back through the FIS to board the ship. It is an unrealistic expectation to examine all passengers for a port visit that may total 8-12 hours when 25-50% of the passenger's time at the destination ports is spent clearing customs and/or immigration. If a port decides to undertake this level of examination, they will need to expend a significant amount on infrastructure (inspection booths) and most likely will not have much cruise ship traffic (due to the passenger waiting period), or what traffic they have will be short lived.

If the destination port decides to clear the entire ship and its passengers for entry, this eliminates the need for the customs clearing infrastructure, and the time associated with processing passengers. Due to the problems mentioned previously, this is the methodology undertaken by most cruise destinations. Many times, the cruise line collects passenger passports while aboard ship. This is done to speed the destination port clearing process. FIS officials can come aboard ship, review the passports and clear the entire ship. This is often times done first thing in the morning before many passengers awake to take land-based excursions. Of course this depends on the location being visited. Some destination ports will not require FIS clearing if the previously visited port was in

the same country, or the countries have reciprocity agreements such as the European Union.

Even though the ships are cleared in full, passengers may still pass through an area traditionally used to control passenger access to the port. Checks are undertaken to ensure passengers are accounted for while ashore. Every passenger carries a ship card identifying them with the cruise. This enables the cruise line to track passengers on the ship and ensure no passengers are left behind. This also ensures unauthorized personnel are not allowed aboard the ship and many times, local FIS personnel use the card as a means to ensure unauthorized personnel are not admitted through the destination port customs inspection area. This is typically accomplished through a photographic match. The cruise identification card is scanned, and a photo, taken at the start of the cruise is displayed on screen. Crew members then verify the photo against the person boarding the ship. The card also acts as a pseudo passport substitute.

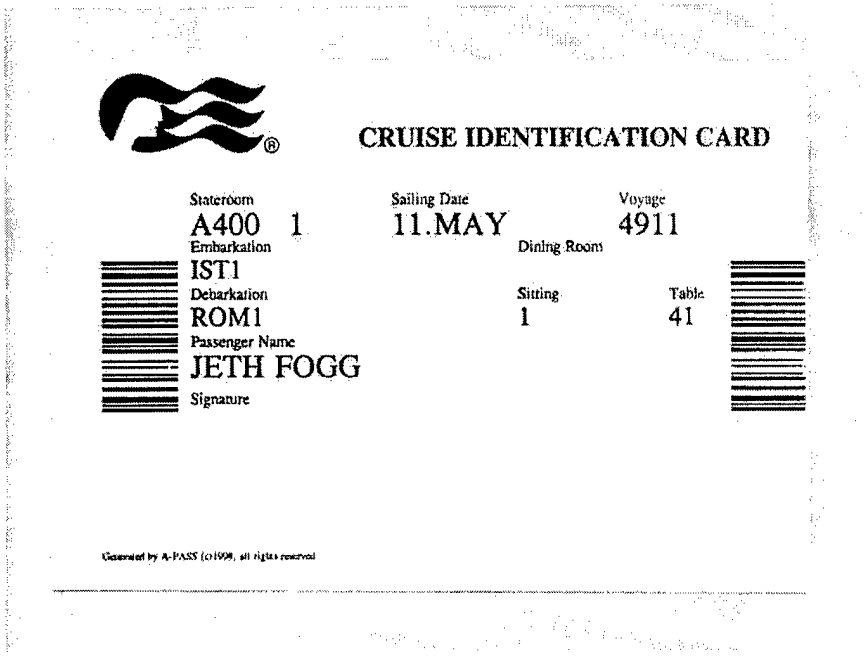


Figure 3.B.3.2 Cruise Identification Card

It is in the best interest for the cruise ship destination port to process the passengers ashore as quickly and smoothly as possible. As mentioned in an earlier

section, this is the passengers only exposure to this location. How they are treated at the port can have a long lasting impression, especially with regard to return visits. The bottom line is that delays in the customs clearing process deprive the passenger of valuable shore time when they could be seeing the local site and/or contributing to the local economy. The quicker passengers arrive ashore the better.

4. Transportation Links

Once ashore, the next concern is with regard to land-based transportation. Are land-based transportation links adequate to support passenger traffic from the ship to the areas of interest at the destination port city and other excursions in the area surrounding it? This question encompasses more than the number of available buses. A study should be made of the traffic flow patterns adjacent to the port and into the adjacent city. If the port has multiple ship visits in a single day, this should also be taken into consideration as more ships compete for the same transportation. Lastly, as traffic continues, the port should consider alternative mass transit to alleviate traffic congestion typically isolated to roadways.

A simple study of the available transportation, similar to that accomplished for the origination ports is the first step. The only difference is that excursions will typically provide their own transportation whereas some basic taxi/shuttle van service will be required into common/shopping areas. This is used to see if the passengers can be accommodated with the simplest type of transit available. Peak load factors, such as multiple ships arriving at the destination port should be considered. Once the vehicle support has been determined, the next area to examine is the traffic flow pattern.

The traffic flow pattern should be designed to eliminate strangle points in the traffic pattern. After all, the goal is to get passengers to their tourist attractions as quickly and smoothly as possible. Stuck in traffic is not the typical cruise vacationer's idea of a good time. If traffic in the port area is a considerable problem, local officials should consider alternative means of transportation to and from the port area.

Alternative transportation means may include such modes as a light rail connection, aerial tramway, larger buses, or water taxis. These alternatives are designed to alleviate traffic congestion, putting fewer vehicles on the road. In all instances, these alternate connections should be used to deliver passengers to common areas of interest that are geographically separated. To ensure local transportation authorities are behind such development, emphasis should be given on the use of the system by local residents. The cruise ship passenger portion of the system is part of a larger operation that could serve the entire community, not just cruise passengers. In this manner, all are served best. Realizing that many of these systems don't require vast infrastructure development, they may be the easiest systems to implement. For example, increasing the size of buses and introducing water taxis are fairly low dollar investments and can have good utilization throughout the population. These systems will have limited capacity, especially under peak demand, but they can alleviate traffic congestion. On the other hand, light rail is a significant capital investment, but can significantly reduce traffic congestion regardless of environmental conditions. The level of investment desired is dependent on the community and their overall port development goals.

5. Excursions

Excursions are an essential part of every cruise vacation and the reason many travelers go on this type of vacation. The passengers want to experience the best the destination port has to offer. They want a "taste" of a new place to see if it is what they like. The excursion experience is controlled by the cruise lines and local tourism associations. From a port planning perspective, the only contribution to this experience is by moving passengers to and from the port in a quick and comfortable manner. This was best addressed in the passenger processing and transportation links of the destination port section. Some tours require extensive travel and coordinated efforts by both the cruise line and the tour agency. In some instances,

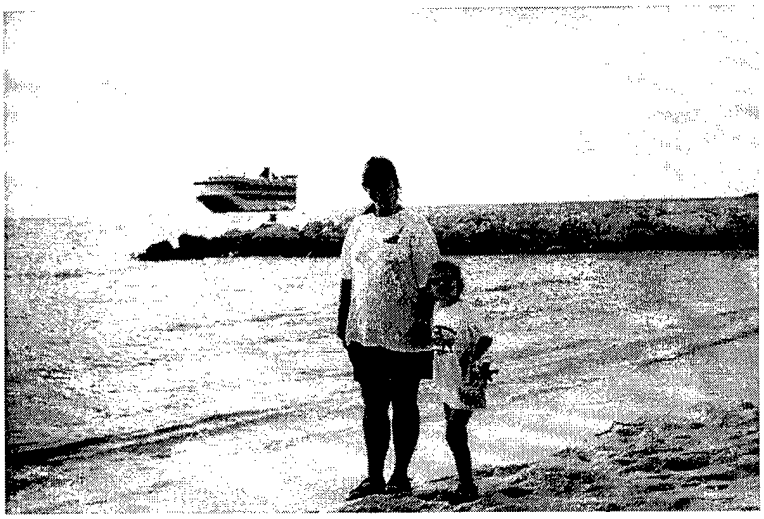


Figure 3.B.5.1 Passengers Enjoy the Beach in the Bahamas

Royal Caribbean
ALASKA

SHORE EXCURSION TICKET RECEIPT

CODE	TOUR	QUANTITY	PRICE: (Adult/Child)	TOTAL
SY101	White Pass Scenic Railway		$75.00A/$38.00C	
SY102	Skagway Vintage Streetcar Tour		$35.00A/$18.00C	
SY103	Glacier Flight & Float Trip		$198.00	
SY104	Historical Skagway		$24.00A/$12.00C	
SY105	Glacier Bay Scenic Flight		$122.00	
SY106	Klondike Summit Tour (via Hwy.)		$29.00A/$14.00C	
SY107	Gold Rush Helicopter Tour		$143.00	
SY108	Visit an Alaskan Homestead		$62.00A/$31.00C	
SY109	Summit/Gold Rush Trail Combo		$38.00A/$19.00C	
HS201	Haines City & Cultural Tour		$27.00A/$18.00C	
HS202	Chilkat Dancers & Salmon Bake		$48.00A/$25.00C	
HS203	Nature Tour & Salmon Bake		$90.00A/$56.00C	
HS204	Chilkoot Lake Boat Tour		$49.00	
HS205	Chilkat Bald Eagle Preserve Jet Boat		$59.00 (2.5 hrs.)	
HS206	Chilkat Dancers & Haines Highlights		$32.00A/$22.00C	
HS207	Alaska Nature Tour		$59.00A/$40.00C	
HS208	Haines Salmon Bake		$23.00A/$14.00C	
HS209	Fort Seward Bicycle Tour		$33.00A/$20.00C	
HS210	Haines Glacier Flightseeing Tour		$113.00	
HS211	Chilkat Bald Eagle Preserve Jet Boat		$79.00 (4 hrs.)	
JN301	Mendenhall Glacier Helicopter Tour		$143.00	
JN302	Flight to Taku Glacier Lodge		$158.00	
JN303	Gold Creek Salmon Bake		$24.00A/$14.00C	
JN304	Juneau Highlights Tour		$28.00A/$14.00C	
JN305	Juneau Sportfishing		$143.00	

Figure 3.B.5.2 Alaska Excursion Worksheet

ship movements are coordinated with tours. For example, passengers are dropped off at one port, and through the tour they are transported to the next port the ship berths at. Another interesting issue associated with tours is the cruise lines involvement with tour bookings, which can be as lucrative as the cruise itself. To encourage passengers to take cruise line sponsored tours, the threat of leaving late passengers behind looms over their head. In other words, passengers on non-cruise sponsored tours may be left behind at the port, if they are late returning from their tour. If it is a cruise sponsored tour that runs late, the ship will wait for the tour to return before departing port. This peace of mind may be worthwhile.

Figure 3.B.5.3 The Library in Ancient Ephesus

6. Destination Port Expansion Considerations

The expansion of destination port operations, is a multi-stepped process much like that of homeport operations. Considerations must span all aspects of the destination port operation. Much like the origination port, the first step is to determine growth goals for the port. This means establishing realistic growth goals taking into consideration all aspects of the cruise ship industry. This type of forecasting is well beyond the scope of this research. Expansion of cruise destination port operations is an all-encompassing event requiring the coordination of the local port, tourism, transportation, and government officials.

Once the growth goals have been established, land-based transportation for excursions should be evaluated. Evaluation of existing land based transportation requirements, per the previous example should be compared with growth goals to ensure adequate land based transportation. In the event of congestion, alternative methods of travel to and from the port should be evaluated.

With travel to and from the port handled, the next requirement is to "entertain" more passengers while in port. This entertainment can be viewed in a variety of ways. It can be retail shopping, site seeing, or just relaxing on the beach. Or, the entertainment may incorporate adventure excursions that travel from away from the ship. Regardless, all means of entertainment must be enhanced to their fullest and preserved to maximize potential. Retail shopping should be incorporated into a master plan that includes duty free shopping, shopping in trendy areas as well as outlet shopping. Plans should be developed to provide ground transportation traveling to those areas. A long-standing

trend at destination ports is to develop retail facilities adjacent to the port, especially duty free sales.

In addition to developing the shopping infrastructure, consideration should be given to other areas of interest adjacent to the port. Culturally important, scenic and threatened natural resources of the origination port city and/or country should be saved and highly regarded. Many times, these locations are the tourism draw that keeps vacationers returning for future cruise visits or encourages then to return for longer land-based vacations. This all means additional tourism revenue for the cruise destination port city.

The last physical consideration for the port and the adjacent community is whether the port can handle the additional ship traffic and/or the additional size of new ships. The infrastructure of the port must be sufficient to support the berthing of new/additional ships. This may require berthing additional ships in areas traditionally used for cargo only operations. The terminals associated with these berths may need to be converted into multi-use terminals. Berthing locations may need special modifications to support larger ships. This could entail new mooring dolphins to adequately secure the larger ships.

Depending on cruise traffic volume, another approach would be development of a cruise only section of the port. This area could specialize in the movement of passengers and other goods associated with cruise operations. This may include a cruise-only terminal with specialized intramodal connections to rapidly and efficiently move passengers to and from the cruise port location.

The third and simplest approach would be to revise berth schedules to accommodate ships when berths at the port would otherwise be vacant. The possibilities are endless for different expansion scenarios. Whatever approach to accommodate additional/new ships is considered, maximization of existing facilities should be the first priority. This will prevent the capital investment of funds toward new facilities or berthing locations until maximum capacity is reached. This methodology will result in the greatest profitability for the port and adjacent city.

With the port's physical considerations and the support functions for the cruise destination port expansion addressed, the final step is to market the port to ensure the additional/new ships are sailing at full capacity. This is usually accomplished by a marketing campaign developed by the cruise lines and the destination port community. This highlights the glamour of the port and the adventure of the cruise experience.

CHAPTER IV

METHODOLOGY

The methodology for conducting this research originally started out solely as a compilation of cruise ship port planning factors. Fortunately, the location of Florida International University, in Miami, Florida, assisted this research in an immeasurable way. The proximity of the University to three of the largest cruise ship ports in the world, Port of Miami, Port Everglades and Port Canaveral was very helpful in gathering critical information concerning port operations and physical characteristics required to support cruise ship operations. But upon closer examination of the cruise ship industry and the ports supporting the industry, a discovery was made, and a future problem uncovered.

The discovery was made with regard to the impending dramatic increase in passenger and ship volume ready to consume the cruise industry and the ports utilized by the industry. The existing growth characteristics associated with the cruise ship industry are quite impressive. The growth has been remaining around ten percent annually for the past few years, which by all business accounts is excellent, but growth is poised to increase dramatically. The factors associated with this growth are outlined in the executive summary at the beginning of this dissertation.

It became evident that this extensive growth in the industry would create some significant problems throughout cruise ship ports worldwide, and specifically origination ports. The problem will be one of growth management. How do the ports handle the extra capacity required to manage the additional ships and passengers, as they cruise

industry continues to compete with the cargo industry for berth spacing. The collection and consolidation of cruise ship port planning factors was still a worthy endeavor, and is exceptionally valuable as a centralized resource in the planning and design for cruise port operations. But the larger requirement for the future was developing a better way to manage the incredible growth looming over the cruise ship industry.

The solution was to develop a means to more efficiently manage passenger and ship traffic while still meeting the basic requirements of cruise ship operations. This efficiency is measured on several fronts. It means better utilization of manpower, funding, berthing space and the environment at origination ports. Origination ports have a significant limiting factor in that cruise ships have a large surge in operation during weekends. This weekend turnaround of the ships is due to traditional vacation planning associated with a week off starting on the weekend. Given the large weekend turnaround, the requirement became developing a manner to handle more ships and passengers in the same available space and timeframe. This led to reintroduction of a previously used design concept, the finger pier, to maximize ship berthing. But maximizing the ship berthing is not enough, passenger processing is also crucial. This is where the centralized finger pier terminal concept came into being.

This general concept of a centralized finger pier terminal was borrowed from the airline industry for application to the cruise ship industry, with some modification based on personal knowledge and information collected from existing port operations. The centralized finger pier terminal concept would be developed for cruise origination ports having significant demand. This layout would enable multiple ships to berth at a pier simultaneously, saving valuable waterfront. Saving the waterfront would minimize the

impact on existing wetlands and minimize environmental mitigation required for the development of new port space. This new concept would allow for centralized processing of passengers on and off ships, minimizing baggage handling requirements and centralizing inspection personnel associated with the Federal Inspection Station (FIS). All these impacts result in a net savings in manpower and funding for the long-term development of the ports.

CHAPTER V

CONCLUSION

The cruise industry is growing steadily at approximately ten percent annually, but the market is starting to get constrained with existing port operation conditions. In the future the situation will be exacerbated when market demand spikes. This dissertation highlighted the factors listed below as contributing to the tremendous growth in the cruise industry marketplace.

1. The potential repeal of the Passenger Vessel Services Act (PVSA).
2. The retirement of ships from the U.S. market to the Pacific Rim market.
3. The shift in cargo operations.
4. The continuing increase in cargo volume.
5. Expansion of cruise lines and their growth rate.
6. The aging baby boomers generation within the U.S. and the ensuing increase associated with leisure time demands.
7. The perceived value of cruise vacations versus traditional land-based vacations.

Each of these factors contributes to the potential for significant growth in the world-wide cruise ship market. The individual impact of each factor listed above is further explained previously in the executive summary.

This dissertation was written to address this future problem on two fronts. The first is through compilation of cruise ship port planning factors as a consolidated resource to assist the design and construction of origination and destination cruise ports. The

second was through the introduction of the centralized cruise ship finger terminal design concept. The planning factors are useful over a large range of applications with regards to origination and destination cruise ship ports. As a centralized resource, they will be helpful to the design and planning of future cruise ports in a rapid, thorough and all-inclusive manner. The centralized cruise ship finger terminal design concept was

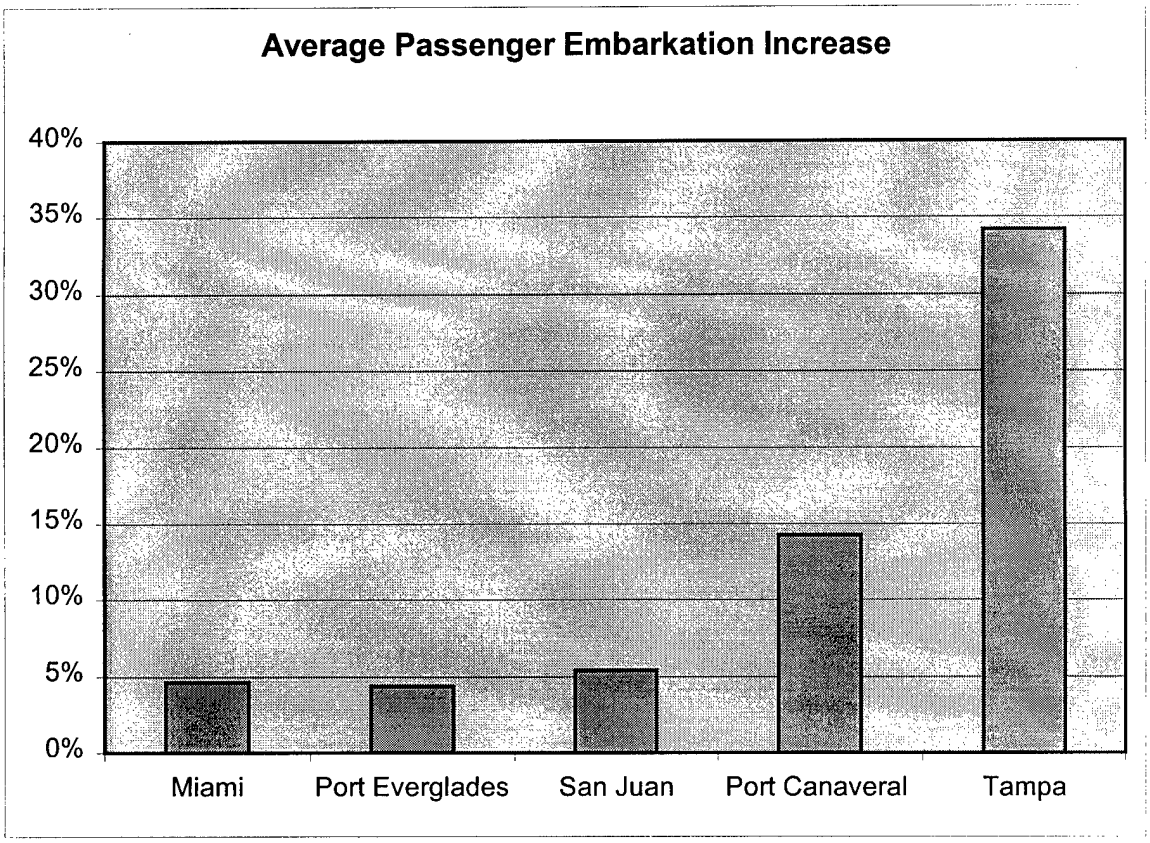


Figure C.1 Recent Average Embarkation Increases at Origination Ports

envisioned for origination ports having a high volume of passenger and ship traffic.

Currently, the Port of Miami is without question, the largest cruise port in the world. The port averages roughly 1.5 million embarkations annually, and modest growth at this port is expected in the future. But now the port is seeing growing competition for other area ports. Port Everglades recently beat out the Port of Miami for a large contract

with Princess Cruise Lines and Royal Caribbean Cruise Lines. Port Canaveral has seen recent rapid growth approaching 15% annually, and they are planning on constructing several new dedicated cruise terminals. Tampa is also constructing new facilities for homeport operations, and they have seen dramatic growth approaching 35% annually averaged between 1990 and 1998. Growth in this market is likely to continue, but probably not at this astounding rate. San Juan is also growing at a modest rate, but growth will likely not continue at a dramatic rate due to the additional expense (air travel) associated with cruise operations from Puerto Rico.

All of these ports have a percentage of the market share, but the Port of Miami is

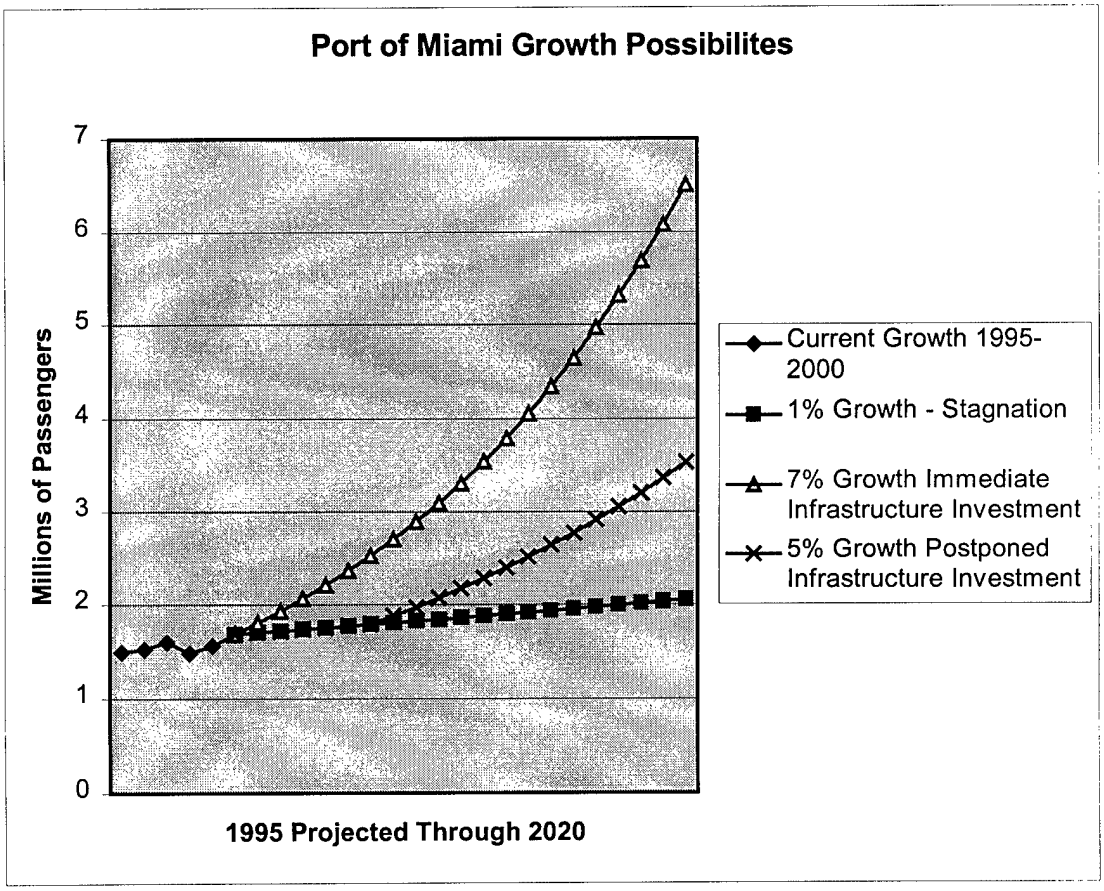


Figure C.2 Port of Miami Growth Possibilities

starting to lose ground when compared to some of the smaller Florida ports. In the future, the ports that continue to make capital investments into the cruise operation will continue to gain market share. Just such investments are being made at Port Canaveral and Tampa, ports, whereas the Port of Miami is built out with regard to traditional cruise berths. Because of this build out, the Port of Miami may be looking at a grim future with regard to continued cruise ship/passenger volume. Figure C.2 gives an indication of what growth may look like for the port under current practices. The port has had significant passenger embarkation growth in the past. Current growth is attributed to the larger cruise ships now utilizing the port. In the future, growth will taper off as market share continues to be shifted to other origination ports serving the same destination ports. Without significant investment, the Port of Miami can expect growth to stagnate around 1% in the future. A significant capital investment would remedy this problem, and get the port back on track for future development with growth expected around 7%, like the remainder of the North American cruise market. If investment is delayed, the port can expect to lose market share until the investment is completed. This will result in long-term loss of market share that will not be recaptured.

The capital investment needed to remedy such loss of long-term market share is significant. Figure C.3 is a proposed plan for a multilevel centralized cruise finger terminal applied to the Port of Miami. This design gives the port the cruise port expansion capability it desperately needs to be competitive in the cruise market of the future. This design will keep cargo operations at the port intact, while simultaneously allowing for massive expansion of cruise operations. This takes an area currently used to serve three average cruise ships and makes it capable of serving eight mega-ships (1000

feet plus). This development would not take place all at once, but could be staged as cruise line expansion (new ships) continues.

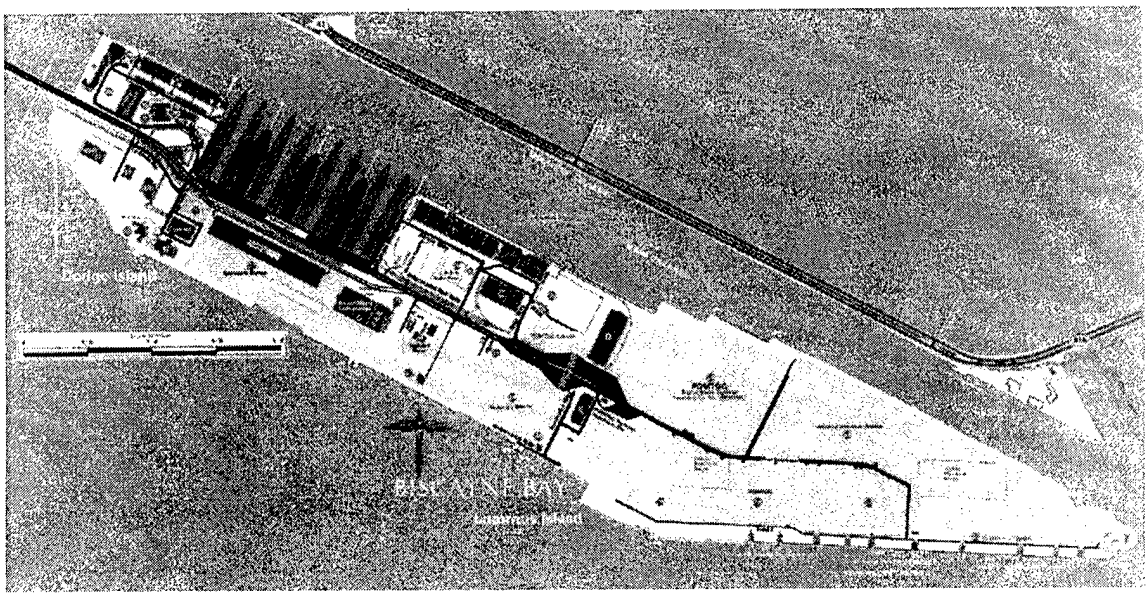


Figure C.3 Port of Miami Proposed Centralized Cruise Finger Terminal

It is hoped that this information will be used by the cruise ship industry, port designers and planners as they work toward developing ports of the future. The projections of cruise ship industry growth were simplified, and made on the grounds of recent growth, but growth exceeding these amounts is very possible. Time will be the true indicator of growth, planners and designers can only estimate, but nonetheless, growth is inevitable. Forecasting the annual growth rate for the next twenty years goes well beyond the scope of a civil engineering dissertation. The important thing is that the industry is growing and tools need to be implemented to manage the growth. The information provided within this dissertation are some of the tools required to get the job done.

Cruise ship ports have been around for many years and the industry has flourished and expanded within existing ports. Now, environmental regulation and public opinion

are becoming restrictive and the industry is starting to get root bound. The situation will be exacerbated with the looming spike in market demand. This demand prediction is supported by the several factors discussed earlier. All of these factors contribute to significant future growth in the worldwide cruise ship market. Hopefully the information contained herein will be used as a guide to solve future cruise ship port planning growth management problems.

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APPENDICES

A. Ship Information

B. Federal Inspection Station Checklist

APPENDIX A - Ship Information

Ship Name	Operator	Year Built or Refurbed	Year Built	Gross Tonnage	Ship Length (ft)	Ship Beam (ft)	Ship Draft (ft)	# of Pax	Pass/Crew ratio	# of Crew	# of Cabins	Engines
Sun Dream	Air Tours Sun Cruises	1997	1970	23005	637	79	22	1150	28.3	400	502	D
Carousel	AirTours Sun Cruises	1995	1971	23200	637	79	22	1200		434	531	D
Carnival Destiny	Carnival	2000	1996	101353	893	116	27	2642	2.4	1000	1321	D/E
Carnival Spirit	Carnival	2001		84000	960	106		2124	2.3			
Carnival Triumph	Carnival	2000		102353	893	116		2766	2.4			
Carnival Victory	Carnival	2000		101509	893	116		2758	2.5			
Celebration	Carnival	2000	1987	47262	733	92	25.5	1486	2.2	670	743	D
Ecstasy	Carnival	2000	1991	70367	855	103	26	2040	2.2	920	1020	D/E
Elation	Carnival	1999	1998	70367	855	103	26	2040	2.2	920	1022	D/E
Fantasy	Carnival	2000	1990	70367	855	103	26	2040	2.2	920	1022	D/E
Fascination	Carnival	1999	1994	70367	855	103	26	2040	2.2	920	1020	D/E
Holiday	Carnival	2000	1985	46052	727	92	25.5	1452	2.2	670	726	D
Imagination	Carnival	2000	1995	70367	855	103	26	2040	2.2	920	1020	D/E
Inspiration	Carnival	1999	1996	70367	855	103	26	2040	2.2	920	1020	D/E
Jubilee	Carnival	2000	1986	47262	733	92	25	1486	2.2	670	743	D
Paradise	Carnival	1999		70367	855	103		2040	2.2			
Sensation	Carnival	2000	1993	70367	855	104	26	2040	2.2	920	1020	D/E
Tropicale	Carnival	1999	1982	36674	671	87	23	1022	1.8	550	511	D
Century	Celebrity	1995	1995	70606	815	105	24.6	1750	2.0	843	875	D
Galaxy	Celebrity	1997	1997	77713	865	105	25	1870	1.9	908	935	D
Horizon	Celebrity	1997	1990	46811	682	95	23.6	1354	2.1	645	677	D
Infinity	Celebrity	2001		91000	965	105		1950				
Mercury	Celebrity	1997	1997	77713	852	105	25	1888	2.0	908	935	D
Millennium	Celebrity	2000		91000	965	106		1950	1.9			
Zenith	Celebrity	1999	1992	47255	682	95	23.6	1354	2.1	657	687	D
Clipper Adventurer	Clipper Cruise L.	1992	1976	3940	328	53	15	100		805	50	D
Club Med I	Club Med Cruises		1990	14745	674	82	25	386		178	193	D
Allegra	Costa		1992	28430	617	85	27	1030		418	403	D

Ship Name	Operator	Year Built or Refurbed	Year Built	Gross Tonnage	Ship Length (ft)	Ship Beam (ft)	Ship Draft (ft)	# of Pax	Pass/Crew ratio	# of Crew	# of Cabins	Engines
Atlantica	Costa	2000	2000	84000	960	106	27	2112	2.1		1056	
Classica	Costa	2000	1992	53000	722	102	25	1308	2.0	610	654	D
Costa Rivera	Costa	1995	1963	30361	701	84	28	1472		470	483	S/T
Marina	Costa		1990	25558	572	85	26	1025		391	380	D
Romantica	Costa	2000	1993	54000	722	102	25	1356	2.2	610	678	D
Victoria	Costa	2000	1996	76000	824	105	26	1928	2.4	800	964	D
Crystal Harmony	Crystal	2000	1990	49400	790	91	25	940	1.7	545	480	D/E
Crystal Symphony	Crystal	1999	1995	51044	778	98	25	940	1.7	545	480	D/E
Caronia	Cunard	1999	1973	24492	627	82	27	665	1.7	390	376	D
Queen Elizabeth 2	Cunard	1999	1967	70327	963	105	32.6	1791	1.7	1000	951	D
Aida	Deutsche Seetouristik	1996		38600	578	77.4	27	1186		370	593	D
Disney Magic	Disney	2000		85000	964	106		2400	2.5			
Disney Wonder	Disney	2001		85000	964	106		2400	2.5			
Black Prince	Fred Olsen	1999	1966	11209	471	66	20	412		200	237	D
Black Watch	Fred Olsen	1998	1972	28492	674	83	25	761		330	428	D
Europa	Hapag-Lloyd Cruises		1982	37012	655	94	27.6	600		300	316	D
Amsterdam	Holland America	2000		61000	780			1380	2.4			
Maasdam	Holland America	2000	1993	55451	720	101	25	1266	2.1	588	632	D/E
New Amsterdam	Holland America		1983	33930	704	89	25	1210		542	605	D
Noordam	Holland America	2000	1984	33930	704	90	25	1214	2.1	542	605	D
Rotterdam	Holland America	2000	1997	62000	778	106	25	1316	2.3	644	660	D/E
Ryndam	Holland America	2000	1994	55451	720	101	25	1266	2.1	588	632	D/E
Statendam	Holland America	2000	1993	55451	720	101	25	1266	2.1	588	632	D/E
Veendam	Holland America	2000	1996	55451	720	101	25	1266	2.1	588	632	D/E
Volendam	Holland America	2000		65000	780			1440	2.5			
Westerdam	Holland America	2000	1988	53872	798	95	24	1494	2.4	642	747	D/E
Zaandam	Holland America	2000		63000	780			1440	2.5			
Princessa Marissa	Louis Cruise Line	1995	1966	10487	441	65	19	853		185	300	
Edinburgh Castle	Lowline	1994	1966	32753	713	96	28	1158		475	510	S/T
Norwegian Crown	NCL	1996	1988	34250	614	92	24	1052		470	526	D
Norwegian Dream	NCL	1998	1992	50764	754	94	22	1500	2.3	614	623	D

Ship Name	Operator	Year Built or Refurbed	Year Built	Gross Tonnage	Ship Length (ft)	Ship Beam (ft)	Ship Draft (ft)	# of Pax	Pass/Crew ratio	# of Crew	# of Cabins	Engines
Norwegian Majesty	NCL	1999		40876	680	99		1462	2.6			
Norwegian Sea	NCL	2000		42000	700	96		1534	2.4			
Norwegian Sky	NCL	1999	1999	80000	853	106	26	2002	3			D/E
Norwegian Sun	NCL	2001		77104	853	105		2002	2.5			
Norwegian Wind	NCL	1998	1993	50764	623	93	22	1726	2.3	614	623	D
The Norway	NCL	1999		76049	1035	110		2032	2.2			
Marco Polo	Orient Lines	1993	1966	22080	578	77.4	27	850		435	425	D
Arcadia	P&O	1997	1989	63500	811	105	27	1549		650	748	D/E
Aurora	P&O	2000		76000	886	106	26	1800		803	920	D/E
Oriana	P&O	1995	1995	67000	850	105	26	1975		760	914	D
Victoria	P&O		1965	27760				714		417		
Crown Princess	Princess	1998	1990	70000	811	105	27	1590	2.5	696	795	D/E
Dawn Princess	Princess	1997	1997	77000	856	106	26	1950	2.3	900	975	D/E
Golden Princess	Princess	2001		109000	951	143		2600	2.3			
Grand Princess	Princess	1998	1998	109000	951	143	26	2600	2.3		1300	D/E
Ocean Princess	Princess	2000	2000	77000	856	106	26	1950	2.3	900	975	
Pacific Princess	Princess	1992	1971	20636	553	81	24.5	717	1.8	350	305	D
Regal Princess	Princess	1999	1991	70000	811	105	25.5	1590	2.5	696	795	D
Royal Princess	Princess	1995	1984	45500	755	95	25	1200	2.4	520	600	D
Sea Princess	Princess	1998		77000	856	106		1950	2.3			
Sun Princess	Princess	1995	1995	77000	856	106	26	1950	2.3	900	1050	D/E
Paul Gaugauin	Radisson 7 Seas	1999		18800	513	71		320	1.5			
Radisson Diamond	Radisson 7 Seas	2000		20295	420	103		350	1.8			
Seven Seas Mariner	Radisson 7 Seas	2000			670	90		700	1.6			
Seven Seas Navigator	Radisson 7 Seas	1999		30000	560	81		490	2.1			
Song of Flower	Radisson 7 Seas	1999			410	52		180	1.2			
Renaissance I	Renaissance Cruise Line	1989		3990	290	50	12	100		72	50	D
Renaissance II	Renaissance Cruise Line	1990		3990	290	50	12	100		72	50	D
Renaissance III	Renaissance Cruise Line	1991		3990	290	50	12	100		72	50	D
Renaissance VI	Renaissance Cruise Line	1991		4280	297	50	13	114		72	50	D
Renaissance VII	Renaissance Cruise Line	1991		4280	297	50	13	114		72	50	D

Ship Name	Operator	Year Built or Refurbed	Year Built	Gross Tonnage	Ship Length (ft)	Ship Beam (ft)	Ship Draft (ft)	# of Pax	Pass/Crew ratio	# of Crew	# of Cabins	Engines
Renaissance VIII	Renaissance Cruise Line	1992		4280	297	50	13	114		72	50	D
Adventure of the Seas	Royal Caribbean	2001		138000	1020	158		3114	5.1			
Enchantment of the Seas	Royal Caribbean	1997	1997	74137	916	106	25.5	1950	2.5	760	977	D/E
Explorer of the Seas	Royal Caribbean	2000		142000	1020	158		3114	5.1			
Grandeur of the Seas	Royal Caribbean	1998	1996	74000	916	106	25	2446	2.5	760	977	D/E
Legend of the Seas	Royal Caribbean	1997	1995	69130	867	105	24	2064	2.5	760	902	D/E
Majesty of the Seas	Royal Caribbean	1997		73941	880	106		2354	2.8			
Monarch of the Seas	Royal Caribbean	1997		73941	880	106		2354	2.8			
Nordic Empress	Royal Caribbean	1990		48563	692	100		1600	2.3			
Radiance of the Seas	Royal Caribbean	2001		88000	916	106		2446	4.0			
Rhapsody of the Seas	Royal Caribbean	1997	1997	75000	915	106	25	2000	2.6	765	1000	D/E
Sovereign of the Seas	Royal Caribbean	1999		73192	880	106		2274	2.7			
Splendour of the Seas	Royal Caribbean	1998	1996	69130	867	105	24.5	1804	2.4	720	902	D
Viking Serenade	Royal Caribbean	1997		40132	623	89		1512	2.4			
Vision of the Seas	Royal Caribbean	1998		78491	915	106		2000	3.0			
Voyager of the Seas	Royal Caribbean	2000		142000	1020	158		3114	5.1			
Odysseus	Royal Olympic	1987	1962	12000	483	61	24	454		194	226	D
Olympic Countess	Royal Olympic	1996	1976	18000	537	75	19	840		350	423	D
Olympic Voyager	Royal Olympic	2000	2000	25000	590	84	24	840		360	292	D
Stella Oceanis	Royal Olympic	1996	1966	12000	492	69	23	457		235	243	D
Stella Solaris	Royal Olympic	1973	1953	17832	545	72	26	620		330	329	S/T
Triton	Royal Olympic	1992	1971	14155	486	71	21	670		300	378	D
World Renaissance	Royal Olympic	1996	1966	12000	492	69	23	457		235	243	D
Seabourn Goddess I	Seabourn	1997	1984	4250	344	48	14	116	1.2	89	58	D
Seabourn Goddess II	Seabourn	1998	1985	4250	344	48	14	116	1.2	89	58	D
Seabourn Legend	Seabourn	2000	1992	9975	440	63	17	208	1.3	140	106	D
Seabourn Pride	Seabourn	2000	1988	9975	440	63	17	208	1.3	140	106	D
Seabourn Spirit	Seabourn	2000	1989	9975	440	63	17	208	1.3	140	106	D
Seabourn Sun	Seabourn	2000	1988	37845	674	92	23.6	758	1.6	460	384	D
Silver Cloud	Silversea	2000		16800	514	70		296	1.4			
Silver Shadow	Silversea	2000		25000	597	81		384	1.3			

Ship Name	Operator	Year Built or Refurbed	Year Built	Gross Tonnage	Ship Length (ft)	Ship Beam (ft)	Ship Draft (ft)	# of Pax	Pass/Crew ratio	# of Crew	# of Cabins	Engines
Silver Whisper	Silversea	2001		25000	610	82		388	1.3			
Silver Wind	Silversea	2000		16800	514	70		296	1.4			
Sun Vista	Sun Cruises	1990	1963	30440	700	94		1106		580	553	S/T
Sun Viva	Sun Cruises	1991	1991	4280	297	50	13	114		72	50	D
Wind Song	Windstar	2000		5350	440	64		148	1.6			
Wind Spirit	Windstar	2000		5350	440	64		148	1.6			
Wind Star	Windstar	2000		5350	440	64		148	1.6			
Wind Surf	Windstar	2000		14745	617	66		312	1.9			

APPENDIX B – Federal Inspection Station (FIS) Evaluation Worksheet

1. Arrival Gate
# of Arrival Passengers per hour = _____

- Public toilets prior to INS inspection area? _____
- Computer terminals to the secondary inspection stations? _____

2. Immigration and Naturalization Services (INS)
Peak Hour number of Terminating passengers = _____
Number of Transfer Passengers – not processed = _____
Average processing time per passenger – INS = _____
Space required per passenger = _____

# of Piggyback Booths	
General Office Space	
Conference / Training	
Break / Lunch Room	
Secondary Inspection Area	
Interview Room	
Supervisor's Offices	
Port Director's Office	
Clerk / Reception	
Employee Locker and Toilet	
Audit Lab	
Storage	
Hold Room's w/Toilet facilities	
Computer Room	

3. Public Health Service (PHS)
- Isolation area next to FIS inspection area
- Ante room with lavatory and shower _____
- Isolation room and an adjacent private toilet with shower, water closet and lavatory _____
- Exhausted air from the area must be vented outside by separate exhaust system _____
- Isolation area 160SF accommodating a hospital bed, bedside stand and chair _____
- Inspection booths similar to INS, especially in areas receiving refugees _____
- Responsible for adequate human waste removal and disposal from international aircraft arrivals _____

Supervisor's Office	
Clerk / Reception	
General Office Space	
Isolation area	

4. Baggage Claim

- Baggage hold area to coincide passenger arrival with their baggage_____

- Size of baggage claim area and layout

- Baggage carts available? _____ Number? _____

5. Customs Service (USCS) – Check Baggage

Peak hour number of terminating passengers = _____
Proportion of passengers to be customs checked = _____
Average processing time per passenger (minutes) = _____
Space required per passenger = _____

- Treasury Enforcement Communications System Room
- Baggage Inspection Belts/Counters
- Search Rooms – Size?
- Cashier Booths (for fines and taxes) number of cashiers _____working annual collection____
- Office area for USCS Supervisors
- General Office Area
- Vault
- Agent Space

# of Piggyback Booths	
Customs Supervisor	
Customs Office	
In-Bond Room	
Cashiers	
TECS Room	
Search Rooms	
Public Space w/ counters	
Storage Room	
Airport Director and Secretary	
Conference and Training Room	
Customs Patrol	
Employee Locker and Toilet	

6. Animal and Plant Health Inspection Service (APHIS)

- Examine cargo and aircraft for pests and items of agricultural interest
    - Adjacent to USCS baggage inspection with visual and physical access

    - Office and lab separated with full partition and door
        - Adequate lighting and electrical support 2*220Volt Stainless or Formica counters
        - Clear glass wall with venetian blind between office and baggage area
        - Additional space for supervisors and detector dogs #_____
- Responsible for aircraft garbage and refuse disposal MIA system?

Officer in Charge	
Inspector's Office	
Laboratory	
Garbage Disposal unit (HP)	
Supervisor's Office	
Clerk-Stenographer	
Storage	
Conference / Training	
Break / Lunch Room	

7. U.S. Fish and Wildlife Service (FWS)

What was the total travel distance between the stations?

1-2	2-3	3-4	4-5	5-6	6-7

8. Employee Joint FIS Areas
Locker Room - One locker for each full time employee #
Employee Toilets – Not accessible to the public

General Things to Look For:
1. Adequate multilingual signage to direct traffic

2. Alarms on unlocked doors and windows?

3. Central alarm room with alarmed doors and windows under surveillance?

4. Television surveillance throughout FIS area in a command module
- Loading bridges

- Sterile concourses
- Baggage delivery areas
- Apron
- Entire FIS inspection area

5. FIS operation on only one floor? Same level as deplaning?

6. Types of doors between stations and throughout processing area?

7. Any public telephones?

VITA

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8/84 to 5/88	B.S., Civil Engineering University of South Carolina Columbia, South Carolina
5/99 to 12/89	M.E., Civil Engineering University of South Carolina Columbia, South Carolina
1/90 to 12/92	Project Engineer 823d RED HORSE Civil Engineering Squadron Hurlburt Field, Florida
12/92 to 8/95:	Civil Engineering Assistant Professor and Construction Manager for the Field Engineering and Readiness Lab Department of Civil Engineering United States Air Force Academy, Colorado
9/95 to 5/96	Chief of Facility Survey 10th Civil Engineer Squadron United States Air Force Academy, Colorado
5/96 to 6/97	Chief of Heavy Repair 10th Civil Engineer Squadron United States Air Force Academy, Colorado
6/97 to 7/98	Resources Flight Commander 36th Civil Engineer Squadron Andersen Air Force Base, Guam
8/98 to 5/01	Doctoral Student and Adjunct Professor Florida International University Miami, Florida

PUBLICATIONS

Fogg, J.A. (Mar 1994), "RED HORSE in the Desert.", *From the Line in the Sand, Accounts of USAF Company Grade Officers in Support of Desert Shield / Desert Storm*, Air University Press, pp 49-57.

Fogg, J.A., Baus, R.L., and Ray, R.P. (Jan-Feb 1991), "AASHTO Rigid Pavement Design Equation Study." *Journal of Transportation Engineering*, ASCE, Vol. 117, No. 1, pp 124-131.

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Baus, R.L., and Fogg, J.A. (Sep 1989), "AASHTO Flexible Pavement Design Equation Study." *Journal of Transportation Engineering*, ASCE, Vol. 115, No. 5, pp 559-564.

AWARDS

Others

1999 Recipient of the Sam M. Walton Free Enterprise Fellowship
1996 USAF Academy Company Grade Officer of the Year (CGOY)
1996 Jul-Sep USAF Academy, Company Grade Officer of the Quarter (CGOQ)
1996 Jul-Sep USAF Academy, 10th Air Base Wing CGOQ
1996 Jul-Sep USAF Academy, 10th Civil Engineer Group CGOQ
1996 USAF Academy Society of American Military Engineers Bliss Award nominee
Recognizes the most outstanding contribution to military engineering education
1995 Awarded the USAF Civil Engineering Master Badge
1995 Academic promotion to Assistant Professor at the USAF Academy
1994 USAF Academy, Civil Engineering Department CGOY
1994 Apr-Jun USAF Academy Dean of Faculty, Engineering Division CGOQ
1994 Apr-Jun USAF Academy Dean of Faculty, Civil Engineering Department CGOQ
1991 Hurlburt Field CGOY
1991 823d RED HORSE CGOY

DECORATIONS

The Meritorious Service Medal
Air Force Commendation Medal (2 Oak Leaf Clusters)
Air Force Achievement Medal
National Defense Service Medal
Southwest Asia Service Medal (2 Bronze Stars)
Humanitarian Service Medal
Kuwaiti / Saudi Liberation Medal
Kuwait Liberation Medal

MEMBERSHIPS

American Society of Civil Engineers
Institute for Transportation Engineers
Chi Epsilon
Tau Beta Pi
Phi Kappa Phi – Honor Society
Professional Engineering Registration in Florida and Colorado