Port of Miami, Florida
Workshop Report

Introduction

A Port Risk Assessment Workshop was conducted for the Port of Miami on July 24-25, 2000. This workshop report provides the following information:

- Brief description of the process used for the assessment;
- List of participants;
- Numerical results from the Analytic Hierarchy Process (AHP) [1];
- Summary of risks and mitigations discussion; and
- Port of Miami Attributes Summaries.

Strategies for reducing unmitigated risks will be the subject of a separate report.

Assessment Process

The risk assessment process is a structured approach to obtaining expert judgments on the level of waterway risk. The process also addresses the relative merits of specific types of Vessel Traffic Management (VTM) improvements for reducing risk in the port. Based on the Analytic Hierarchy Process (AHP), the port risk assessment process uses a select group of experts/stakeholders in each port to evaluate waterway risk factors and the effectiveness of various VTM improvements. The process requires the participation of local Coast Guard officials before and throughout the workshops. Thus the process is a joint effort involving waterway user experts, stakeholders, and the agencies/entities responsible for implementing selected risk mitigation measures.

This methodology employs a generic model of port risk that was conceptually developed by a National Dialog Group on Port Risk and then translated into computer algorithms by the Volpe National Transportation Systems Center. In that model, risk is defined as the sum of the probability of a casualty and its consequences. Consequently, the model includes variables associated with both the causes and the effects of vessel casualties. Because the risk factors in the model do NOT contribute equally to overall port risk, the first session of each workshop is devoted to obtaining expert opinion about how to weight the relative contribution of each variable to overall port risk. The experts then are asked to establish scales to measure each variable. Once the parameters have been established for each risk-inducing factor, each port's risk is estimated by putting into the computer risk model specific values for that port for each variable. The computer model allows comparison of relative risk and the potential efficacy of various VTM improvements between different ports.

[1] Developed by Dr. Thomas L. Saaty, et al, to structure complex decision making, to provide scaled measurements, and to synthesize many factors having different dimensions.

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Numerical Results

Book 1 – Risk Categories *(Generic Weights Sum to 100)*

Fleet Composition	Traffic Conditions	Navigational Conditions	Waterway Configuration	Immediate Consequences	Subsequent Consequences
11.0	13.8	12.8	19.1	23.2	20.1

Analysis:

Book 1 begins the process of weighting the national port risk model. The participant teams contribute their knowledge, using the AHP process, to provide weights to the six major risk categories. The contribution to the national model by the Port of Miami participants is as listed above. These participants felt that Immediate Consequences was the largest driver of risk. Fleet Composition was a significantly lower influence.

Book 2 - Risk Factors *(Generic Weights)*

Fleet Composition	Traffic Conditions	Navigational Conditions	Waterway Configuration	Immediate Consequences	Subsequent Consequences
11.0	13.8	12.8	19.1	23.2	20.1

% High Risk Deep Draft	Volume Deep Draft	Wind Conditions	Visibility Obstructions	Number of People on Waterway	Economic Impacts
8.8	3.5	2.7	4.6	7.7	3.1
% High Risk Shallow Draft	Volume Shallow Draft	Visibility Conditions	Channel Width	Volume of Petroleum	Environmental Impacts
2.2	1.9	6.5	5.9	4.8	4.9
	Vol. Fishing & Pleasure Craft	Current, Rivers, & Tides	Bottom Type	Volume of Chemicals	Health & Safety Impacts
	2.2	2.0	2.9	10.7	12.1
	Traffic Density	Ice Conditions	Waterway Complexity		
	6.2	1.6	5.7		

Analysis:

Book 2 further refines the weighting for the national port risk model. The participants examined the importance to port safety for each of the 20 risk factors and provided the above results to the national model. They determined that the following factors contribute the most to overall risk under each of the six major categories:

- Fleet Composition: High-Risk Deep Draft Vessels contribute the third highest amount of risk.
- Traffic Conditions: Traffic Density contributes the sixth highest amount of risk.
- Navigational Conditions: Visibility Conditions contribute the fifth highest amount of risk.
- Waterway Configuration: Channel Width contributes the seventh highest amount of risk.
- Short-term Consequences: The Volume of Chemicals contribute the second highest amount of risk and the Number of People on Waterway the fourth-highest amount of risk.
- Long-term Consequences: Health and Safety Impacts contribute the highest amount of risk.

Book 3 Factor Scales - Condition List *(Generic)*

	Scale Value
Wind Conditions	
a. Severe winds < 2 days / month	1.0
b. Severe winds occur in brief periods	2.7
c. Severe winds are frequent & anticipated	4.4
d. Severe winds occur without warning	9.0
Visibility Conditions	
a. Poor visibility < 2 days/month	1.0
b. Poor visibility occurs in brief periods	2.4
c. Poor visibility is frequent & anticipated	4.6
d. Poor visibility occurs without warning	9.0
Tide and River Currents	
a. Tides & currents are negligible	1.0
b. Currents run parallel to the channel	1.9
c. Transits are timed closely with tide	4.9
d. Currents cross channel/turns difficult	9.0
Ice Conditions	
a. Ice never forms	1.0
b. Some ice forms-icebreaking is rare	1.6
c. Icebreakers keep channel open	4.7
d. Vessels need icebreaker escorts	9.0
Visibility Obstructions	
a. No blind turns or intersections	1.0
b. Good geographic visibility-intersections	1.9
c. Visibility obscured, good communications	4.3
d. Distances & communications limited	9.0

Channel Width

a. Meetings & overtakings are easy	1.0
b. Passing arrangements needed-ample room	2.0
c. Meetings & overtakings in specific areas	5.8
d. Movements restricted to one-way traffic	9.0

Bottom Type

a. Deep water or no channel necessary	1.0
b. Soft bottom, no obstructions	2.0
c. Mud, sand and rock outside channel	4.9
d. Hard or rocky bottom at channel edges	9.0

Waterway Complexity

a. Straight run with NO crossing traffic	1.0
b. Multiple turns > 15 degrees-NO crossing	2.9
c. Converging - NO crossing traffic	4.9
d. Converging WITH crossing traffic	9.0

Passenger Volume

a. Industrial, little recreational boating	1.0
b. Recreational boating and fishing	3.2
c. Cruise & excursion vessels-ferries	5.7
d. Extensive network of ferries, excursions	9.0

Petroleum Volume

a. Little or no petroleum cargoes	1.0
b. Petroleum for local heating & use	2.2
c. Petroleum for transshipment inland	4.8
d. High volume petroleum & LNG/LPG	9.0

Chemical Volume

a. Little or no hazardous chemicals	1.0
b. Some hazardous chemical cargo	2.3
c. Hazardous chemicals arrive daily	5.2
d. High volume of hazardous chemicals	9.0

Economic Impacts

a. Vulnerable population is small	1.0
b. Vulnerable population is large	3.1
c. Vulnerable, dependent & small	5.2
d. Vulnerable, dependent & large	9.0

Environmental Impacts

a. Minimal environmental sensitivity	1.0
b. Sensitive, wetlands, VULNERABLE	2.8
c. Sensitive, wetlands, ENDANGERED	5.8
d. ENDANGERED species, fisheries	9.0

Health and Safety Impacts

a. Small population around port	1.0
b. Medium - large population around port	2.6
c. Large population, bridges	5.6
d. Large DEPENDENT population	9.0

Analysis:

The purpose of Book 3 is for the participants to calibrate a risk assessment scale for each risk factor. For each risk factor there is a low (Port Heaven) and a high (Port Hell) severity limit, which are assigned values of 1.0 and 9.0 respectively. The participants determined numerical values for two intermediate qualitative descriptions between those two extreme limits. On average, participants from this port evaluated the difference in risk between the lower limit (Port Heaven) and the first intermediate scale point as being equal to 1.4; the difference in risk between the first and second intermediate scale points was equal to 2.7; and the difference in risk between the second intermediate scale point and the upper risk limit (Port Hell) was 3.9.

Book 4 - Risk Factor Ratings *(Port of Miami)*

Fleet Composition	Traffic Conditions	Navigational Conditions	Waterway Configuration	Immediate Consequences	Subsequent Consequences
9.9	22.4	11.0	27.0	10.5	17.5

% High Risk Deep Draft	Volume Deep Draft	Wind Conditions	Visibility Obstructions	Number of Passengers on Waterway	Economic Impacts
3.0	3.7	3.1	3.1	6.5	5.2
% High Risk Shallow Draft	Volume Shallow Draft	Visibility Conditions	Channel Width	Volume of Petroleum	Environmental Impacts
6.9	5.3	1.5	6.9	2.4	7.7
	Vol. Fishing & Pleasure Craft	Tide & River Currents	Bottom Type	Volume of Chemicals	Health & Safety Impacts
	7.2	5.4	8.3	1.6	4.6
	Traffic Density	Ice Conditions	Waterway Complexity		
	6.2	1.0	8.7		

Analysis:

This is the point in the workshop when the process begins to address local port risks. The participants use the scales developed in Book 3 to assess the absolute level of risk in their port for each of the 20 risk factors. The values shown in the preceding table do NOT add up to 100. Based on the input from the participants, the following are the top risks to port safety in the Port of Miami (in order of importance):

1. Waterway Complexity (8.7)
2. Bottom Type (8.3)
3. Environmental Impacts (7.7)
4. Volume of Fishing & Pleasure Craft (7.2)
5. % High Risk Shallow Draft (tie) (6.9)
6. Channel Width (tie) (6.9)

Book 5 - VTM Tools *(Port of Miami)*

Fleet Composition	**Traffic Conditions**	**Navigation Conditions**	**Waterway Configuration**	**Immediate Consequences**	**Subsequent Consequences**

% High Risk Deep Draft		**Volume Deep Draft**		**Wind Conditions**		**Visibility Obstructions**		**Number of Passengers on Waterway**		**Economic Impacts**	
15	0.1	**16**	0.0	**14**	0.2	**13**	0.3	**10**	1.3	**9**	1.4
RA		RA		RA		RA		RA	ALERT	OTH	
% High Risk Shallow Draft		**Volume Shallow Draft**		**Visibility Conditions**		**Channel Width**		**Volume of Petroleum**		**Environmental Impacts**	
5	2.7	**12**	0.9	**19**	-0.7	**6**	2.6	**18**	-0.6	**3**	3.9
IRR		IRR	ALERT	RA		VTIS	ALERT	RA		OTH	ALERT
		Vol. Fishing & Pleasure Craft		**Tide & River Currents**		**Bottom Type**		**Volume of Chemicals**		**Health & Safety Impacts**	
		4	2.9	**8**	1.9	**1**	4.1	**20**	-0.8	**11**	1.1
		IRR		IDI	ALERT	OTH		RA		RA	ALERT
		Traffic Density		**Ice Conditions**		**Waterway Complexity**					
		7	2.0	**17**	-0.3	**2**	4.0				
		VTIS	ALERT	RA		IRR	ALERT				

Legend:

See the **KEY** (below). Rank is the position of the Risk Gap for a particular factor relative to the Risk Gap for the other factors as determined by the participants. Risk Gap is the variance between the existing level of risk for each factor determined in Book 4 and the average acceptable risk level as determined by each participant team. Negative numbers imply that the risk level could INCREASE and still be acceptable. The teams were instructed as follows: *If the acceptable risk level is equal to or higher than to the existing risk level for a particular factor, circle RA (Risk Acceptable). If the mitigation needed does not fall under one of the VTM tools, circle OTH (Other) at the end of the line. Otherwise, circle the VTM tool that you feel would MOST APPROPRIATELY reduce the unmitigated risk to an acceptable level.*

The tool listed is the one determined by the majority of participant teams as the best to narrow the Risk Gap. An ALERT is given if no mathematical consensus is reached for the tool suggested. Below are the tool acronyms and tool definitions.

KEY	
Risk Factor	
Rank	Risk Gap
Tool	ALERT

RA	Risk Acceptable	IDI	Improve Dynamic Navigation Info
IAN	Improve Aids to Navigation	VTIS	Vessel Traffic Information System
ICM	Improve Communications	VTS	Vessel Traffic System
IRR	Improve Rules & Regulations	OTH	Other – not a VTM solution
ISI	Improve Static Navigation Info		

Analysis:

The results shown are consistent with the discussion that occurred about risks in the Port of Miami area. For 9 out of the 16 risk factors for which there was good consensus, the participants judged the risk to be at an acceptable level already due to existing mitigation strategies.

No consensus alerts occurred for the following reasons:

- Volume Shallow Draft – Votes split between RA (5), IRR (6), OTH (1)
- Traffic Density – Votes split between RA (1), ICM (1), IRR (3), IDI (1), VTIS (5), OTH (1)
- Tide & River Currents – Votes split between RA (3), IAN (1), IDI (6), VTIS (2)
- Channel Width – Votes split between RA (2), ICM (2), IRR (1), VTIS (3), VTS (1), OTH (3)
- Waterway Complexity – Votes split between IAN (1), IRR (4), IDI (2), VTIS (1), OTH (4)
- Volume of Passengers – Votes split between RA (6), IRR (3), VTIS (1), VTS (1), OTH (1)
- Environmental Impacts – Votes split between RA (2), IRR (4), IDI (1), OTH (5)
- Health & Safety Impacts – Votes split between RA (5), ICM (1), IRR (2), VTIS (1), OTH (3)

Summary of Risks

Scope of the port area under consideration: The participants defined the geographic bounds of the port area to be discussed.

1. Approach to Miami (especially for Bahamas due to crossing traffic): Begin 4 NM east of sea buoy (10 miles off shore). Cruise ships approaching sea buoy also have to line up and maintain station while they await their turn in the queue for pilots and entry time.
2. Offshore anchorages.
3. Dodge/Lummus Island and adjacent waterways including Main Channel, Fisherman Channel (Dodge Island Cut and Lummas Island Cut) channels, West turning basin.
4. Western limits of Port defined as MacArthur Causeway Bridge to the north and Dodge Island Bascule Bridge to the south.

The Miami River was not included due to the unique nature of its geography and trade. Instead, that waterway will be the subject of a separate risk assessment workshop.

RISK FACTORS	RISKS	MITIGATIONS
Fleet Composition		
% High Risk Deep Draft Cargo & Passenger Vessels	• Problem with deep draft vessels at low tide; very close to bottom of channel. • High quality low risk ships • Schedules for cruise ships are such that there are requirements for rapid turnaround and equipment sometimes does not get repaired before departure. • Less than 10% - Port State Control Category I and Category II; very few Category I vessels) • There have been some groundings from steering going out, but, overall, risk from deep draft ships is very low in this port.	**Existing mitigations:** • Category I vessels require a boarding at sea buoy. • Category II vessels require annual examination by USCG.

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RISK FACTORS	RISKS	MITIGATIONS
Fleet Composition (Continued)		
% High Risk Shallow Draft Cargo & Passenger Vessels	• Miami high risk shallow draft vessels include Caribbean coastal freighters, commercial fishing boats, a few OSVs, and recreational boats. • Majority of problems that pilots report are on coastal freighters --"river ships." 1. Experience steering loss and engine loss 2. Quality of crews is very poor; they do not speak English. 3. Antillean Line ships are good quality and not to be confused with them • Amphibian aircraft taxi and launch from the West turning basin. Have to look for gaps in recreational boaters to land. Run risk of flying into a cruise ship while dodging recreational boaters. • Recreational boats: 1. Competence of operators. Ignorance of operators affecting operations in entrance channel and turning basin 2. Limited access to ocean. Next access is Haulover Inlet 3. Lots of educational courses available, but few are taken. 4. Material condition of recreational boats is poor. Frequently break down. Pilot boats have to tow them out of the way. 5. Speed of recreational boats—ignore speed signs and lack good judgment. • Commuter/ferry boats: 1. Fisher Island Ferry crosses main channel every 15 minutes. • Fishing boats: 1. Recreational fishing boats. Most are small. 6. Wing-net shrimp boats are commercial. Fish in the South Channel - along its entire reach.	**Existing mitigations:** • Level of risk is not considered acceptable. • Pilots on small high-risk freighters report to USCG and identify the risks. • Mandatory pilotage of shallow draft cargo vessels • Pilots hand out waterway education pamphlets. • Licensing and inspection requirements for some class vessels • STCW requirements • International Safety Management Code (ISM) **New mitigations:** • Coastal Freighters: 1. Eliminate older, unsafer ships. 2. Improve communications with pilots and tow boat operators. 3. ISM Code will apply to all ships in 2002, including coastal freighters. • Commercial fishing vessels 1. Shrimpers are uninspected now; mandatory inspection program may be next. • Recreational vessels 1. Encourage educational courses 2. Mandatory licensing for operators 3. More stringent requirements for vessel rental businesses (state requirement) 4. Increase enforcement of existing laws 5. Target high risk areas for enforcement activities • Increase number of enforcement officials on the waterways

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RISK FACTORS	RISKS	MITIGATIONS
Traffic Conditions		
Volume of Deep Draft Vessels	**Today:** • Weekends 4 to 6 cruise ships line up to depart within 2-hour period in late afternoon. • Arrivals also—several jockey for entrance within small window of time. • 7,000 movements per year in deep draft category (movements defined by pilots as one-way transit) • Volume of deep draft traffic. Miami able to handle additional deep draft traffic. • Container ships: size limited by depth of channel. Larger Maersk ships cannot enter with Panamax vessels. • Port emphasis is on passenger carriers, not container ships. • Discussion to dredge channel to 50 feet from entrance to Fishermans Channel & Main Channel • Constraint on large container ships is size • Fishermans Channel needs to be deepened and widened. • Turning basin in Dodge Island Cut needs to be increased in size too. 1. Too small for container ships to use 2. Container ships have to turn in confluence of Lummus Island Cut and Meloy Channel. 3. Discussion July 24 at port to dredge to 50' • Deep draft casualties. No trend. Casualties rare. **Trends:** • If Cuba opened to trade, significant increase of traffic expected 1. Estimate doubling of traffic in river 2. Impact on Port of Miami not clear yet • Cruise ship industry steady in number for past several years but ships have gotten bigger • New terminals planned for Watson Island • Possible new sites at Bay Side • Dodge Island Cargo side (Fishermans Channel; new gantry cranes to accommodate container ships • SW edge Dodge Island Passenger Pier 12 may accommodate passenger vessels	**Existing mitigation**: • Pilots coordinate departure and arrival times and order for ships. **New mitigations:** • Plan for expanded trade when Cuba opens. • Dredge turning basin for cargo ships south of Dodge Island.

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RISK FACTORS	RISKS	MITIGATIONS
<u>Traffic Conditions</u> (Continued)		
Volume of Shallow Draft Vessels	**Today:** Caribbean coastal vessels, offshore fishing vessels, a few OSVs, ferries • 3,000 movements per year. Pilots define a movement as one way transit • Very little commercial fishery activity in Miami • Fisher Island Ferry crossings: Sheer number of trips (1 millionth trip this summer); every 15 minutes as housing construction increases. **Trend:** • Massive increase in volume of shallow draft, especially if Cuba opens up • Number of Fisher Island ferry transits is increasing from two to three ferries in operation in season. • Miami River will be dredged which will increase flow of traffic 1. Transits no longer restricted to high tide 2. Deeper draft “River Max” vessels will be used • Increasing trend in gambling and dinner cruise passenger vessels • Tugs are remaining constant.	**Existing mitigation**: • Pilotage of coastal freighters is mandatory

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RISK FACTORS	RISKS	MITIGATIONS
Traffic Conditions (Continued)		
Volume of Fishing & Pleasure Craft	**Today:** • FMP enforcement activities limited by availability of resources • Marinas: Bay Side, Watson Island, north of MacArthur Causeway, Miami Beach, Dinner Key • Major sight seeing area • Transits from north and south ICW • Launch areas, Watson Island, mainland, Miami Beach Marina • 50,000 registered boats in Dade county • Restrictions on jet skis to the north are driving them south to this area. To south, they are excluded from parks. • Advertisers claim Port of Miami is one of top ten places to use jet skis • Seasonal shrimping by recreational craft in middle of Fisher Island Ferry route • Jet skis use Main Channel as playground and government cut **Trend:** • Plans to increase recreational boat areas on Miami River, including waterside restaurants	**Existing mitigations:** • Level of risk mitigation is not adequate today • County ordnance for jet ski regulations defining where they can and cannot operate. Specifically addresses distance from port and distance from deep draft ships in channel • Speed regulations • On water presence of law enforcement, especially during movement of ships • Educational pamphlets available for recreational boaters **New mitigations:** • Establish speed zones for the port • Establish exclusion zones for jet skis

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RISK FACTORS	RISKS	MITIGATIONS
<u>Traffic Conditions</u> (Continued)		
Traffic Density	• Congestion area at times: 1. Any major holiday. Fire works at Bay Side, Entrance of Miami River 2. Long spring/summer/fall for weekend boaters 3. East end of Lummus Island, always 4. Fishing tourneys: Watson Island 5. Offshore speedboats race through Main channel 6. Miami Boat Show; multiple sites 7. Hurricane port closures; all deep draft vessels exiting the channel 8. Hurricane port closure; smaller/recreational vessels heading up the Miami River	**Existing mitigation:** • Bertram Yacht Yard has large number of slips it rents as safe haven for hurricanes

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RISK FACTORS	RISKS	MITIGATIONS
Navigational Conditions		
Wind Conditions	• 20-25 knots cause concern for deep draft vessels • Cold fronts, weekly, in winter with 25 knot sustained winds. Well predicted. • Summer unpredictable thunderstorms with micro bursts which include tornadoes • Onshore wind with outgoing tide in entrance channel at jetties creates 6 to 7 foot waves and 4 knot current • Winter: northerly winds, cross channel • Berth 172 on south channel during thunderstorm requires doubling mooring lines • Deep draft vessels in anchorage have dragged anchor	**Existing mitigation:** • Rely on weather information from Doppler radar.

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RISK FACTORS	RISKS	MITIGATIONS
<u>Navigational Conditions</u> (Continued)		
Visibility Conditions	• Fog: not much of a problem. Occurs 7 days per year • Visibility poor during thunder storm. Visibility to zero. During winter fronts time can be half day. During summer thunderstorms, 15 to 30 minutes.	**Existing mitigation:** • Short run enables ships to wait out a micro burst

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RISK FACTORS	RISKS	MITIGATIONS
<u>Navigational Conditions</u> (Continued)		
Tide & River Currents	• Sea buoy cross current makes approach to channel difficult at times. Sometimes get a counter current to the south! • Jetties on a flood tide have two cross currents- inner to south, outer is to north which creates turning vortex • Turning basin east of Lummas, convergence of three currents • Cross current from Norris Cut onto the gantry dock • Downtown turning basin cross current coming through ICW. Cruise ships have to take them into account • Heavy rains in summer create stronger than normal ebb tides • Water management areas also impact ebb tide flow • Cut to west of Dodge Island restricted • Ebb current generates rips and "standing waves" which create dangerous situation for recreational boaters: inexperience, inadequate seakeeping characteristics of craft, and lack of power • Recurring casualties: Pleasure craft loose control in currents/seas in entrance channel, swamp	No mitigation factors were discussed.
Ice	• Not applicable for Port of Miami.	

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RISK FACTORS	RISKS	MITIGATIONS
Waterway Configuration		
Visibility Obstructions	• Pilots: Background lighting a problem pilots have discussed with the port. Ganrties are brightly lit. • Two 25-degree turns approaching main ship channel. Government cut masked by Miami beach buildings • Blind turn at east end of Lummas Island • Blind turn at Lummus/Dodge Island Cut-gantrys, containers, container ships • Approaching Miami, cruise ships cannot see sea buoy when approaching from seaward due to Miami Beach and Fisher Island lights • Range lights are visible inbound • Fisher Island Ferry – lights on MacArthur Causeway mask small recreational boaters and on Lummus Island containers block traffic on the south side	**Existing mitigations:** • Existing bridge-to-bridge radio communications • Range lights well placed

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RISK FACTORS	RISKS	MITIGATIONS
<u>Waterway Configuration</u> (Continued)		
Channel Width	• Only certain areas where two ships can meet inbound • No meeting at Beacon #15 or at the jetties • At SW end of Dodge Island (junction of the ICW), pilots leave shallow draft freighters, tugs connect for dead ship tow, and river pilot gets aboard • Casualty. Coastal barge at Fisher Island terminal got clipped by cruise ships • Buoy #1 shoals in channel have caused groundings of large cruise liners.	**Existing mitigations:** • Level of risk is acceptable for port • Pilots impose one-way traffic for deep draft cruise ships • Exclusive use of waterway when a tanker is moving • Pilot Office Dispatcher on duty 24 hours and monitors movement and location of all vessels in greater port areas with pilots • Pilot web page available to entire port community on ship movements. Updated every 15 minutes • Port suspends cargo operations when passenger vessel is transiting on south side • COTP imposes requirements and restrictions for ships with exceptions or which pose extraordinary risks

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RISK FACTORS	RISKS	MITIGATIONS
<u>Waterway Configuration</u> (Continued)		
Bottom Type	• Hard rock banks, very sheer and unforgiving. • Cable crossing areas off gantries, Bay 115, cannot use anchors in emergency w/o risk • FPL power line off gantries. Restricts draft to 39 feet. • Submerged sewer line under Government Cut channel. Buoy #14 marks the shallow part of sewer line. Ships could nick the pipe. It is exposed at one corner of the channel in 38 feet. • Submerged power cable between ferry slip and east end of Lummus Island. Has been nicked by anchors • Shoaling offshore on north and south sides of the edge of the channel at buoy #1. Cruise liners have touched during approach	**Existing mitigations:** • Buoy #14 to marks exposed 56" sewer pipe • Aids to navigation • Ranges • Under-the-keel clearance rules: State approved (annually). Pilots, company reps, port authority establish advisory of 3 feet under keel on approach, 2 feet under keel in channels • Feel level of risk needs to be brought down **New mitigations:** • Real time current meter at sea buoy • Eliminate unsafe shoal spots by dredging (buoy #1, beacon #15) • Better identify unsafe shoal spots through education, accurate charting, aids to navigation • Dredging now involves moving rock—dynamite/explosives. Technological alternatives need to be developed

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RISK FACTORS	RISKS	MITIGATIONS
<u>Waterway Configuration</u> (Continued)		
Waterway Complexity	• Greatest risk in harbor is fuel farm at Fisher Island. Ship turning in basin could hit barge. • Two 25 degree bends in Main channel • Converging waterways: 1. Lummus Island Cut and Government Cut 2. Norris Cut into Lummus Island Cut 3. ICW at Dodge Island 4. Biscayne Bay short cut to Fishermans Cut • Once inside sea buoy, deep draft vessels are committed • Anchorages are limited and poor holding • Ongoing channel maintenance: very little because there is no shoaling. • Project dredging will occur but planned • Cruise ships turn at West end of Dodge Island – junction with ICW • Cargo side: turning basin not dredged deep enough, commercial ships turn at confluence of Government Cut, Main, Lummus Island Cut • Crossing traffic 1. Fisher Island Ferry 2. North and south bound traffic at sea buoy 3. Southbound traffic tries to stay close in to dodge Gulf Stream 4. Mixing Bowl: Convergence of multiple traffic patterns at sea buoy	**Existing mitigations:** • 1 NM Precautionary Area. Buffer around sea buoy to keep southbound traffic away from entrance to Port of Miami and anchorage • Pilots admonish ships that ignore Precautionary Area. Also hand out explanatory pamphlet • Good buoyage • Pilotage requirements in place • FMRI (Florida Marine Research Institute) for public boater education guides. Has been done for Broward and Dade Counties • Florida Marine Patrol on scene • Moving safety zones • Scheduled ferry crossing (Coast Pilot) and bridge to bridge • Commercial vessel make security broadcasts as they transit channels **New mitigations:** • Pilots be provided ferry schedule (15'); ferry broadcasts its departure • Turning basins drive high-risk level. Look at alternatives to existing turning basin configurations • Mitigate approach at sea buoy: make precaution area larger, 4 NM suggested • Require larger recreational vessels to make safety broadcasts as they transit • Reduce/control speeds of go fast vessels • Restrict jet ski use in areas of commercial traffic

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RISK FACTORS	RISKS	MITIGATIONS
Immediate Consequences		
Volume of Passengers	• Cruise ships: Number of crew and passengers ~3,000 • Eight T-boats with dinner cruises run down the Main Channel and around the residential islands • Four casino boats with up to 150 passengers run off shore through the Main Channel • Water taxis from Bay Side to hotels, Miami River, Miami Beach Marina • Chalk's Airline transits • Some tour boats from the hotels • Harbor cruise and casino boats. Royal Star (100 Pax) and Princess (100 pax) to run offshore. • Fisher Island passenger ferry • Fisher Island commercial barge ferry (2x daily for next 5 years) **Trend:** • Size of cruise ships increasing • Ferry traffic increasing • Water taxi traffic increasing (tourists)	No mitigation factors were discussed.

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RISK FACTORS	RISKS	MITIGATIONS
Immediate Consequences (Continued)		
Volume of Petroleum Cargoes	• Petroleum terminals: One small one at Fisher Island for ships that need bunkers and Florida Light and Power • Tankship unloads 100,000 bbls twice monthly • Bunkering up to 2,000 (42 gal/bbl and 8 bbl/ton) • 12,000 bbls barge once per day to Turkey Point power plant via South channel and ICW • 12 bunker jobs per week for passenger ships • No trained fire fighting crews aboard tugs. No fire boat. USCG not equipped to fight ship fires. Port of Miami does not have capability to fight serious fire aboard either cruise liner or commercial cargo vessel	No mitigation factors were discussed.

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RISK FACTORS	RISKS	MITIGATIONS
Immediate Consequences (Continued)		
Volume of Hazardous Chemical Cargoes	• Less than 10% of cargo tonnage is HAZMAT and comes as container cargo • No bulk shipments of HAZMAT • HAZMAT does transit offshore.	No mitigation factors were discussed.

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RISK FACTORS	RISKS	MITIGATIONS
Subsequent Consequences		
Economic Impacts	• If the waterway shuts down: 1. Hurricane: mass migration of traffic out. Start warning 72-hour mark to 48-hour mark. After 36-hour mark, no more arrivals. After 24-hour mark, all out. After storm channels are surveyed. Two days prior and up to three days after for port closure. 2. Impact of closure is immediate. Passenger ships moving thousands of people in and out of port. Ships have alternate ports but have to match them to buses, air transit. • One week period before cargo delivery shortages felt • Impact on tourism: 1. Dollars lost by dinner cruise boats 2. Dollars lost by gambling boats 3. Dollars lost by tour boats 4. Cruise liners • Ferries may not be able to visit the outlying communities. • Shrimp fisheries are impacted if an oil spill occurs. • Will be economic impact throughout Caribbean islands dependent upon receiving goods from Miami	No mitigation factors were discussed.

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RISK FACTORS	RISKS	MITIGATIONS
Subsequent Consequences		
Environmental Impacts	• Sanctuaries: 1. South of Dodge Island to Virginia key sea grass beds are protected environmentally sensitive area. 2. Coral reefs off shore, two shallow, one deep, run parallel to coast. Ship channel is cut through them • Spawning grounds and nurseries for crustaceans • Miami beach recreation • Manatee areas everywhere • Biscayne Bay aquatic preserve • Entire bay is environmentally sensitive area • Spill booming strategies may not be adequate with regard to currents within port • Groundings in approaches • Gray water-holding tanks: ships required to hold which increases draft. Do not discharge before they leave port because no adequate facility to accept it gray water.	**Existing mitigations:** • Risk is not considered to be at acceptable level today • Area Contingency Plan • Pre-staged response • Regular training for oil spills • NRS & MSRC OSROs present • Phasing out single skin petroleum barges • Use double hull barge on transit to Turkey Point • Voluntary guidelines for controlling invasive species **New mitigations:** • More detailed information available from NOAA plot, predict currents, salinities, wind and weather • Review existing ACP for currency and adequacy • Review existing equipment for currency and adequacy • Identify bunker tank locations: bottom or side and double hull • Mandatory regulations for invasive species • Facilities to accept gray water; black water

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RISK FACTORS	RISKS	MITIGATIONS
Subsequent Consequences (Continued)		
Health and Safety Impacts	• 600,000 people in Miami plus tourists, especially Miami Beach • Very rich people's housing on islands • Sectional power loss if underwater power cables are clipped • Offshore grounding of ships with hazmat cargoes could create toxic plumes, other harmful impacts • Important species in port: 1. Shrimp 2. Manatees 3. Sea grass nurseries 4. Lobsters 5. Stone crabs	**Existing mitigations:** • Drinking water not an issue; piped from elsewhere.

Summary of Port of Miami Waterway Navigational Attributes

- ***Ship Channel Complexity:*** Narrow approach, strong cross-current, strong turning torque at jetties, difficult turn into south channel at beacon 15 on flood tide, reduced channel width (Lummus Island Cut by extended gantry & vessel cranes), unforgiving hard rock shoals & banks. Confluence of 3 channels (Main, Meloy, Fishermans).

- ***Converging or Crossing Traffic:*** North/southbound vessel traffic at sea-buoy, vessels headed for anchorage, North & South channel outbound vessels converge in Fisher Island Basin, Fisher Island Ferries cross channel.

- ***Ship Channel Configuration:*** Dredged channel through rock, 500' wide on approach through Government cut then 400' wide inside. Project depth 44' & 42' to container berth / 36' project depth up main channel. 25' depth in remainder South channel. 6 NM from sea-buoy to main Turning Basin, 2.5 NM in South (Fishermans) Channel and 0.5 NM approach to the Miami River, 5.8 NM /approx. a 14' depth up River.

- ***Ship Channel Traffic:*** 10,000 ship movements per year: large deep draft container ships, Ro/Ro vessels, passenger ships, tankers with hazardous cargo, small coastal freighters, tug and barge.

- ***Recreational and Local Fishing Activity:*** Large numbers of recreational boat and personal watercraft all year. Seasonal shrimping and lobster boats present in dredged channels.

- ***Bottom:*** Hard rock bottom and banks, rocky/sand anchorage.

- ***Currents:*** Strong Gulf Stream current at sea-buoy, very strong tidal currents in inside channels, strong cross currents in Government Cut at the head of the jetties.

- ***Wind:*** Trade winds generally blow from South East, however, winter fronts, local summer thunderstorms & tropical storms/hurricanes can bring severe strong winds from any direction.

- ***Visibility:*** Generally good, except when driving rain reduces visibility. Zero visibility conditions occur about 7 days a year.

Port of Miami
Vessel Traffic Management Profile
(Presently in Place)

- ***Aids to Navigation (USCG and Private)***

  - *Lighted & Unlighted – Fixed & Floating:* USCG maintained

  - *Electronic Aids:* GPS, Morse (A) RACON

  - *Traffic Separation Schemes (TSS) –IMO:* None

  - *Regulated Navigation Areas (RNA) – USCG*: Precautionary Area established for a 1-mile diameter around the sea buoy.

- ***Vessel Traffic Systems (VTIS/VTS):*** None

- ***Situation Awareness (Each Ship)***

  - *Own Ship's & Other Ship's Position:* Situational awareness derived by harbor pilot communication between vessels, visual & radar observation by the pilot, and through vessel traffic coordination by Biscayne Bay Pilots dispatcher.

  - *Other Ship's Intentions:* Through pilot radio communication with other vessel and through the Biscayne Bay Pilots dispatcher.

Port of Miami
Planned and Anticipated Changes

- ***Planned Infrastructure Developments:*** Dredging south channel to 42' up to Bay 172 then 36' up to terminal 12. Request ACOE to expand and deepen eastern turning basin, and deepen entrance channel and eastern portion of gantry crane area to 50'.

- ***Changes in levels and/or nature of waterway activities:*** None.

- ***Forecast Traffic Levels:*** No changes.

- ***USCG Regulations to be implemented:*** None.

- ***Changes under consideration, but not committed:*** None.