Port of San Juan, Puerto Rico, After Action Report

Introduction.

A Port Risk Assessment was conducted for the port of San Juan, Puerto Rico 7 – 8 February 2000. This report will provide the following information:

- Brief description of the process used for the assessment;
- List of participants;
- Numerical results from the Analytical Hierarchy Process (AHP); and
- Summary of risks and mitigations discussion.

Follow-on strategies to develop and implement unmitigated risks will be the subject of a separate report.

Process.

The risk assessment process is a disciplined approach to obtaining expert judgements on the level of waterway risk. The process also addresses the relative merit of specific types of Vessel Traffic Management (VTM) improvements for reducing risk in the port. Based on the Analytic Hierarchy Process (AHP)[1], the port risk assessment process involves convening a select group of expert/stakeholders in each port and conducting structured workshops 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. Identification of local risk factors/drivers and selecting appropriate risk mitigation measures is thus accomplished by a joint effort involving experts and stakeholders, including both waterway users and the agencies/entities responsible for implementing selected risk mitigation measures.

This methodology hinges on the development of a generic model of vessel casualty risk in a port. Since risk is defined as the product of the probability of a casualty and its consequences, the model includes variables associated with both the causes and the effects of vessel casualties. The model uses expert opinion to weight the relative contribution of each variable to the overall port risk. The experts are then asked to establish scales to measure each variable. Once the parameters have been established for each risk-inducing factor, the port's risk is estimated by inputting values for the variables specific to that port into the risk model. The model also produces an index of relative merit for five VTM levels as perceived by the local experts assembled for each port.

[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.

Participants.

The following is a list of stakeholders/experts that participated in the process:

Participant	Organization	E-mail address
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Numerical Results.

Book 1 - Factors *(Generic Weights sum to 100))*

Fleet Composition	Traffic Conditions	Navigational Conditions	Waterway Configuration	Short-term Consequences	Long-term Consequences
6.8	14.2	18.9	12.5	24.6	23.0

Analysis:
The participants contributed the above scores to the National Model. They determined that the consequences, long and short term, are the largest drivers of risk. There was some debate about the low number assigned to the Fleet Composition factor.

Book 2 - Risk Subfactors *(Generic Weights)*

Fleet Composition	Traffic Conditions	Navigational Conditions	Waterway Configuration	Short-term Consequences	Long-term Consequences
6.8	14.2	18.9	12.5	24.6	23.0
% High Risk Deep Draft	Volume Deep Draft	Wind Conditions	Visibility Obstructions	Volume of Passengers	Economic Impacts
5.5	4.3	4.4	2.8	10.4	4.6
% High Risk Shallow Draft	Volume Shallow Draft	Visibility Conditions	Passing Arrangements	Volume of Petroleum	Environmental Impacts
1.3	1.3	9.7	4.7	5.5	5.6
	Vol. Fishing & Pleasure Craft	Currents, Tides, Rivers	Channel and Bottom	Volume of Chemicals	Health & Safety Impacts
	1.5	2.6	1.4	8.7	12.8
	Traffic Density	Ice Conditions	Waterway Complexity		
	7.1	2.2	3.6		

Analysis:
The participants contributed the above results to the national model. Subfactors contributing the most to overall risk under each of the six major factors were:

- For the Fleet Composition factor, High-Risk Deep Draft Vessels contribute more risk than Shallow Draft.
- For Traffic Conditions, Traffic Density contributes the greatest amount of risk to the waterway.
- For Navigational Conditions, Visibility Conditions contribute the most.
- For Waterway Configuration, Passing Arrangements contributes the most followed by Waterway Complexity.
- For Short Term Consequences, The Volume of Passengers contributes the most.
- For Long Term Consequences, Health and Safety contribute the most.

Book 3 Subfactor Scales - Condition List (Generic)

	Scale Value
Wind Conditions	
a. Severe winds < 2 days / month	1.0
b. Severe winds occur in brief periods	3.1
c. Severe winds are frequent & anticipated	5.2
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	2.6
c. Poor visibility is frequent & anticipated	4.9
d. Poor visibility occurs without warning	9.0
Current, Tide or River Conditions	
a. Tides & currents are negligible	1.0
b. Currents run parallel to the channel	2.0
c. Transits are timed closely with tide	4.7
d. Currents cross channel/turns difficult	9.0
Ice Conditions	
a. Ice never forms	1.0
b. Some ice forms-icebreaking is rare	2.1
c. Icebreakers keep channel open	5.3
d. Vessels need icebreaker escorts	9.0
Visibility Obstructions	
a. No blind turns or intersections	1.0
b. Good geographic visibility-intersections	2.1
c. Visibility obscured, good communications	4.6
d. Distances & communications limited	9.0
Passing Arrangements	
a. Meetings & overtakings are easy	1.0
b. Passing arrangements needed-ample room	2.5
c. Meetings & overtakings in specific areas	6.5
d. Movements restricted to one-way traffic	9.0
Channel and Bottom	
a. Deep water or no channel necessary	1.0
b. Soft bottom, no obstructions	1.7
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	3.0
c. Converging - NO crossing traffic	5.0
d. Converging WITH crossing traffic	9.0

Passenger Volume

a. Industrial, little recreational boating	1.0
b. Recreational boating and fishing	3.1
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	2.8
c. Petroleum for transshipment inland	5.1
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	5.3
d. High volume of hazardous chemicals	9.0

Economic Impacts

a. Vulnerable population is small	1.0
b. Vulnerable population is large	3.3
c. Vulnerable, dependent & small	5.3
d. Vulnerable, dependent & Large	9.0

Environmental Impacts

a. Minimal environmental sensitivity	1.0
b. Sensitive, wetlands, VULNERABLE	2.9
c. Sensitive, wetlands, ENDANGERED	6.0
d. ENDANGERED species, fisheries	9.0

Safety and Health 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 participants contributed the above calibrations to the Subfactor scales for the national model. For each Subfactor above there is a low (Port Heaven) and a high (Port Hell) severity limit, which are assigned values of 1 and 9 respectively. The participants determined numerical values for two intermediate qualitative descriptions between those two extreme limits. In general, 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 the difference in risk associated with the first and second intermediate scale points. The difference in risk between the second intermediate scale point and the upper risk limit (Port Hell) was generally 2.5 times as great.

Book 4 Risk Subfactor Ratings (San Juan)

Fleet Composition	Traffic Conditions	Navigational Conditions	Waterway Configuration	Short-term Consequences	Long-term Consequences
% High Risk Deep Draft 7.3	Volume Deep Draft 6.9	Wind Conditions 4.5	Visibility Obstructions 5.1	Volume of Passengers 5.7	Economic Impacts 5.8
% High Risk Shallow Draft 4.9	Volume Shallow Draft 5.2	Visibility Conditions 2.8	Passing Arrangements 7.4	Volume of Petroleum 8.3	Environmental Impacts 6.2
	Vol. Fishing & Pleasure Craft 3.3	Currents, Tides, Rivers 2.6	Channel and Bottom 5.2	Volume of Chemicals 5.7	Health & Safety Impacts 4.5
	Traffic Density 7.5	Ice Conditions 1.0	Waterway Complexity 8.2		

Analysis:

Based on the input from the participants, the following top risks occur in San Juan (in order of importance):

1. Volume of Petroleum
2. Waterway Complexity
3. Traffic Density
4. Passing Arrangements
5. High Risk Deep Draft

Comment:

Although not immediately obvious from the tabulated results from the risk assessment, the associated discussions included allegations that the existing traffic management regimen was at the point of failure, with potentially catastrophic impact upon marine safety within the port and the economy of the Commonwealth. It was postulated that additional stress; such as might be imposed by increases in vessel traffic volume or ship size, could well produce “chaos”. The concerns voiced appear to stem from a perceived lack of leadership and shortfalls in the exercise of authority by the Commonwealth Captain of the Port. The validity of the allegations must be determined and corrective action taken, if warranted, as a matter of high priority.

Book 5 (San Juan)

Subfactor	Book 4 Results	Book 5 Results Avg	Book 5 Results Std Dev	RA	IER	INI	IAN	IEA	AIS	EAIS	VTIS	VTS	Combined Results Delta	Combined Results Rank	Combined Results Tool
Waterway Complexity	8.2	4.5	1.57	0	2	1	1	0	1	1	6	0	3.7	1	VTIS
Volume of Petroleum	8.3	4.7	1.44	0	7	0	0	0	1	0	3	1	3.6	2	IER
Passing Arrangements	7.4	4.3	1.54	1	5	0	1	0	0	1	3	1	3.2	3	IER
Traffic Density	7.5	4.8	1.48	0	3	0	1	0	0	1	4	3	2.8	4	VTIS
% High Risk Deep Draft	7.3	4.6	1.38	0	7	0	1	0	0	0	3	1	2.7	5	IER
Volume Deep Draft	6.9	4.8	1.80	2	3	0	0	0	1	1	4	1	2.1	6	VTIS
Visibility Obstructions	5.1	3.3	1.48	0	1	0	2	0	3	1	4	1	1.9	7	VTIS
Environmental Impacts	6.2	4.4	1.56	2	4	0	0	0	2	0	2	2	1.8	8	IER
Economic Impacts	5.8	4.2	1.27	2	4	0	0	0	3	0	2	1	1.6	9	IER
Volume of Chemicals	5.7	4.1	1.44	1	6	0	0	0	1	0	3	1	1.6	10	IER
Volume of Passengers	5.7	4.5	1.98	4	4	0	0	0	0	0	3	1	1.2	11	RA
Health & Safety Impacts	4.5	3.5	1.00	2	5	0	0	0	0	0	3	2	1.0	12	IER
Volume Shallow Draft	5.2	4.3	1.37	6	1	0	0	0	0	1	2	2	0.9	13	RA
Channel & Bottom	5.2	4.3	0.98	3	1	6	1	1	0	0	0	0	0.9	13	INI
% High Risk Shallow Draft	4.9	4.5	1.24	5	5	0	0	0	0	1	1	0	0.4	15	RA
Visibility Conditions	2.8	2.8	0.97	6	0	0	1	0	2	2	1	0	0.0	16	RA
Wind Conditions	4.5	4.6	1.31	7	1	1	0	0	0	1	2	0	-0.1	17	RA
Ice Conditions	1.0	1.3	0.62	12	0	0	0	0	0	0	0	0	-0.3	18	RA
Vol. Fishing & Pleasure Craft	3.3	3.6	1.68	9	2	0	0	0	0	0	1	0	-0.3	19	RA
Currents, Tides, Rivers	2.6	3.3	1.22	10	0	0	0	0	1	1	0	0	-0.7	20	RA

Legend:

If the acceptable risk level is higher or equal to the existing risk level for a particular subfactor, circle RA (Risk Acceptable) at the end of that line. Otherwise, circle the VTM tool that you feel would MOST APPROPRIATLY reduce the unmitigated risk to an acceptable level.

IER = Improve Existing Rules (pilotage rules, standard operating procedures, licensing requirements).
INI = Improve the existing Navigation Information (charts & hydrographic information) for the port.
IAN = Improve the existing short range Aids to Navigation (buoys and lights) in the port.
IEA = Improve the existing Electronic Aids to navigation (LORAN, GPS, GMDSS) in the port.
AIS = implement an Automatic Identification System for the port.
EAIS = implement an Enhances Automatic Identification System for the port.
VSC = improve the Vessel traffic Service Communications capabilities.
VSI = improve the Vessel traffic Service infrastructure (radars & cameras).

Analysis:

This is very consistent with the discussion that occurred about risks in the port area of San Juan Harbor. The mitigations discussed to reduce the risks in Book 4 (above) seem to be best addressed by a simple **improvement to the existing rules.**

- Waterway Complexity was rated the highest risk subfactor and the tool of the VTIS was determined to be the best fit..
- The gathering of myriad vessels off San Juan Harbor main channel is easily controlled by a VTIS, first, and by regulation, second. New regulations will require consistent enforcement, however.
- Updated and tested contingency plans will serve to address how to mitigate consequences of a harbor closure due to a petroleum spill.

Scope of the port area under consideration: (The participants addressed the geographic bounds of the waterway **)**	
Port area	**San Juan Harbor, to include** • *From sea to three and a half miles north of El Morro; this includes the pilot boarding area* • *Refinery flumes that are in line with ranges (background lighting problem for the ranges)* • *Dredged area in the harbor*

Risk Factors	Risks	Mitigations
Fleet Composition		
% High Risk Deep Draft Cargo & Passenger Vessels Defined in terms of poor maintenance, high accidents, quality of crew	Some risks discussed were: 1. Serious problem – communications – **language and culture** of the crew. • Foreign flag crews – tankers an cargo ships – from eastern countries and SE Asia – **culture of the crew doesn't allow them to admit the condition of their vessel. Will not tell when a problem exists** until it happens. • Problem – engine will not go astern on command • I can go astern after coming full ahead (recharge air flask) • Philippine deck crew, Indian officer – diverse crews and officers…as many as 5 languages • Full Indian crews spoke very good and maintained their vessels • Russian crews have language probs and maintenance probs 2. Some retreaded ships have more mixed crews – nothing like experiences on tankers, car carriers, and bulk carriers 3. The problem ships number – 3-5 tankers a week, maybe less. 4. No rep of PR Port Authority at the PAWSA session 5. Port state Priority 1 vessels – 5 percent or less; 35 percent Priority 2 vessels (from COTP) 6. American fleet is aging – well maintained • Steering gear operating off EDG is not required and grand-fathered – not required • Includes all American ships • Eight ships a week 7. Port controllers contribute following risk: • do NOT speak proper English. • do not have the know how… • don't know how difficult to maneuver the cruise ships 8. Maneuvering challenges: • Holding a cruise ships off an occupied dock is a challenge with a cross wind • Tugs are old and lose power while helping large ships	Some of the mitigations discussed were: 1. Requirement to test control equipment – already in regulations 2. Use standby tugs 3. Use communications to avoid close quarters 4. Use standard criteria to determine whether or not to move a vessel – for the pilots 5. Conduct port state control boardings – CG resources are really thin

Risk Factors	Risks	Mitigations
%High Risk Shallow Draft Using a tug boat v. not using a tug boat	1. Vessels 300 feet or larger – don't want to use a tug – present a risk – move all through the harbor 2. Vessels under 200 feet – bad communications – these vessels tend to stand in the middle of the channel and do NOT move. 3. Misinformation presents bottlenecks for ships clearing the docks **(lack of internal coordination within the harbor presents a high risk**) 4. Lost yachtsman gets lost (headed for San Antonio Channel – occurs in the entrance) and stops in the middle of the channel	1. Port control keeps the 200 foot or less boats in control when then can talk to them 2. Most of the time, the 200 foot or less keep out of the way 3. Most of the commercial fishing vessels are well operated and well maintained. They do NOT pose a risk.
Traffic Conditions	Look also to the future for San Juan Harbor	
Volume of Deep Draft Vessels	1. Passenger -- Volume of ships is decreasing – but more passengers are increasing (bigger ships) 2. Cargo ship are getting larger and the number of transits is increasing • Feeder ships are increasing • Transshipping cargo to the outer islands • Increase in feeder ships from Panama 3. Largest ships – • Container – 925 feet • Eagle class cruise ships – 1080 feet long 4. Cruise ships – 136/month during the winter season (most traffic you can get) 5. Tankers – 850 - 900 feet long – 5-6 per week and increasing – to Gulf refinery and power plant (include Pier Mike)	1.
Volume of Shallow Draft Vessels	1. Feeders have increased and will probably continue to increase – 3-4 per day 2. Coasters have decreased 3. Small tankers are increasing – 4. Increase of large barge traffic – take a long time to maneuver – have no pilot • Carrying containers • Shift with lines, pull bollards out • Show in maneuvering alongside the pier	
Volume of Fishing & Pleasure Craft	1. Best fishing at the entrance buoys early in the morning. 2. Kayaks are increasing…have no lights in twilight • Come into Condodo Bay • Ramps for jet skis also in the bay	1. CG advises pilots of fishing tournaments in the harbor

Risk Factors	Risks	Mitigations
Traffic Density	1. Deep draft – during early morning hours vessels are **at entrance channel and lined up offshore** 2. **Post hurricane** – ships want to go in and out. • ATON must be checked • Port needs cargo 3. Golden Triangle (Pier 1 to Pan American dock) – reserved only for cruise ships 4. Cruise ships • **Condensed to the weekend and Tuesdays** • One every 15 minutes • Come in at same time as container ships 5. Outbound vessels meet inbound vessels • Barges have same schedule in as cruise are moving out • In **Entrance Channel** • Cruise ships have priority • Sometime the Cruise ships are not ready to leave dock 6. **Port fees** – new day begin after daylight • Getting density for ships reporting at 2355 • Becoming a lineup **7. Poor administration of the port** • Last minute notice to pilots • Fixed fee of 25 per hour for pilot to wait • Agent will have pilot wait • Traffic will wait for agent to clear ship 8. Dredge in the middle of the channel will obstruct the traffic	1. Decision to move ships after hurricane is being made by the COTP – honest broker 2. Pilots generally give the time they will move ship 3. Better inform the Port Controller 4. Port Fees – bill for number of hours – put dockage and port fees together 5. Consider VTM tools to use: • Changing rules – flexible start time • AIS to sort out ships milling around the entrance • AIS for everyone to see what everyone else is doing • AIS to validate information on vessels coming in/going out – determining when underway • Rules – established by port authority to control departing/transiting ships • Rules – watch the scheduling of the waterway to allow for slower traffic in the gap for faster traffic • Coordinate shore facilities with incoming ships • Rules – enforce traffic rules – provide penalties • VTS will standardize procedures, improve training, provide enforcement…use COTP authority
Navigational Conditions		

Risk Factors	Risks	Mitigations
Wind Conditions	1. Steady trade winds with occasional hurricane 2. High winds are defined as over 25 knots 3. There is a problem maneuvering ships with large sail areas 4. During wind shifts – small ships wait too long to get a tug lined up 5. Wind problems are experienced both inside and outside of the harbor 6. Wind in entrance channel – ship must crab inbound and must straighten out when they get into lee • 20 – 25 degree offset (cruise ships) • Speed to 13 knots, then slow rapidly (cruise ships) 7. Pilot boarding inside the harbor (cruise ships) – preferred • Outside, ship must slow – prefer to keep speed • Hydraulic doors – open out – present risk to pilot • Should board between 2-3 miles outside • Will board after the entrance buoys • Depends on WX conditions • If board inside, pilot boat leads the cruise ship in; and pilot has direct comms with ship and with conn • Like to use pilot boat to advise if channel is clear 8. Strongly southerly wind – catch people off guard 9. Slow moving traffic obstructs fast moving ships that must maintain speed to maneuver in wind conditions 10. Frequency: Nov to March – seasonal • Swells follow the 3000 mile fetch if it blows for awhile • Occurs more than 2 days a month – 25-30 kts • Well forecast	
Visibility Conditions	1. Low visibility during rain in heavy downpours • Variable in duration – could be a whole day • Occur about once a month • Predicted 2. Volcanic ash – reduce visibility – cannot see the ranges	
Currents, Tides and Rivers	1. Along-shore current in entrance channel sets ship to the west • Current reverses – with cold front, current will run to east quite strongly offshore. When vessel moves toward shore, current will shift to the west. • Harbor entrance – two problems – current and swell	

Risk Factors	Risks	Mitigations
	2. Small current in the harbor 3. In **future**, culvert coming out in Puerto Nuevo – ACOE says that cross current should not increase over 1 kt. 4. Outfall from the power plant, Catano, east side cause a current	
Ice	No ice forms in San Juan Harbor	Not a problem – no mitigation
Waterway Configuration		
Visibility Obstructions *Cannot see ATON or other ships*	1. Port Control cannot see the majority of the harbor…can only see the entrance channel • Cannot see the ships arriving three miles outside • Pilot comms via fax to Port Control is limited 2. Refinery flare blocking the ranges 3. Lose site of entrance ranges at last minute by tug…30 foot ht of eye…blocked by brush … environment considerations (entrance range) 4. Baseball parks with lights –Catano, west of …will impact entrance range 5. Golden Triangle will have more lights I the future 6. Army terminal is effected by moored ships • Barge moored on east side of dock obscure ranges, sometimes 7. Headland at El Morro – cannot see traffic – tugs cannot see around the bend 8. Isla Grande – obstructed to tugs 9. Flood lights at CG station blinds ships in entrance channel 10. Isla Grande dock – has a lot of flood lights 11. Ships following too closely in entrance channel cannot see the ranges	1. Consider putting RAREF on Buoy 1 and 2 2. Better ranges in day time 3. Determine if the entrance range defines the middle of the channel. 4. Move buoy 4 more to center of channel 5. Beacon 3 is in shallow (15 ft) of water – recent survey shows there is more water 6. Check soundings at pier 6
Passing Arrangements	1. Entrance and Army Terminal channel is very narrow- it is one way traffic 2. Only passing spot is Anagado 3. **Future** – increase Entrance channel to 800 feet; Army terminal channel increased 25 feet to each side 4. Shifting winds cause anchored ships in anchorage E to swing, blocking channel 5. Med mooring ships at pier C, Puerto Nuevo 6. Tankers encroaching the channel by 150 feet 7. PA removing fenders at Puerto Nuervo piers	1. Entrance channel will be straighter and wider 2. VTM measures: • Rules – make rules for vessels obstructing the channel • Med moors – rules are made, must be enforced • One way traffic scheme at entrance • One at a time scheme at Puerto Nuevo

Risk Factors	Risks	Mitigations
Channel and Bottom	1. Anchorage E has a wreck 2. South of buoy 6 – hard bottom when ships miss the turn 3. When dredging turning basin – Graving Dock Channel – removed hard limestone 4. In Army channel – going to 40 foot – removed limestone (hard sand)	1. ACOE will be removing the wreck
Waterway Complexity	1. Puerto Nuevo – ships coming in from Army terminal and eastern (graving dock) channel meeting each other 2. Ferries crossing the channels 3. Pushing mud up on eastern side of Pier 4…seems to be getting shallower. Keep waterway across from pier 6 deep • Seem to be a lot of wrecks in this area 4. Army Terminal – ships extend beyond end of piers – four ships have hit the dock due to tug failure 5. Berth A and B have oil lines under the dock 6. While ships have increased, the tugs have not kept up 7. Visiting yachts – anchorage area developing and cruise ships are encroaching on the channel more (next to Frontier piers). Not enuf swinging room to turn ships around 8. Coordination and information flow within the harbor is lacking	1. Consider one way traffic scheme, here 2. Consider surveying bottom adjacent to Pier 4 3. In heavy rain showers, ferries are held at the pier 4. Widen the entrance 5. Straighten out the entrance 6. Port Control to have a better overall view – to better coordinate the traffic • Insure Port Control has better knowledge • Give Port Control authority • Give Port Control authority better communications 7. Require tug escort – must be in the lee of the vessel with current tugs 8. VTM tool to best solve the problem • Have ATON, comms, ACOE dredging project • Have Pilotage rules and regulations • Improve the port control system – seems to be equivalent to a VTIS • Port Control is directing ship movements • VTS – Need to fill a leadership vacuum • VTS – Significant impact on exports from east coast ports • VTS – impact of casualty is unacceptable • VTS – CG pers present to exercise COTP authority • VTS – more monitoring tools in place 9. Establish a pilot commission
Short Term Consequences		
Number of People on Waterway	1. Charter fishing head boats not a problem 2. Ferry operations – 6000 people every day; move 139 passenger on each ferry	1. Proposal for no wake zone in way of CG docks • Ferries have changed routes

Risk Factors	Risks	Mitigations
	• From Catano to San Juan (Pier 2) • Shallow draft – not constrained to channel 3. Cruise ship operations – 4. In future – ferries may move in the Graving Dock Channel 5. Special events – races, regattas, fishing tournaments 6. Saturday, Sunday and Tuesday…Cruise ships every 15 minutes 7. People jumping off ships	• Smaller craft may be affected • Cruise ships are moving slowly, causing little to no wake
Volume of Petroleum Cargoes	1. Barges moving petro to ships, bunkering within the harbor 2. Petro moves in and out of the harbor	San Juan is not a tanker port – risk is high – unacceptable. Consider the following actions: 1. Prepare for a major fire • Tow fire fighting barge to fire • Procure skimmer craft with F/F capability 2. Control causal factors (probability side) • Widen channel • Control shipping 3. Require double hulls 4. Pre-stage clean up equipment • Barge is not located in St. Croix • Barge is not designed to contain • Vessels calling must have OSRO • Couple of OSROS in Quinable (SP?) 5. Contingency Planning at vessel and facility levels 6. Terminal operators have oil spill response equip for their own terminal 7. Most likely will rely on equipment brought in from the mainland 8. Problem: Need more equipment - Consider regulations to require more equipment 9. VTM tools that can help in the response effort – Consider those that control other vessels after the casualty – that coordinate activities
Volume of Hazardous Chemical Cargoes	1. LPG to Catano – in bulk – every 10 days 2. Explosives to San Juan Shipyard – twice a month 3. Acids/gasoline containerized from SJ through Puerto Nuevo – lots moving – every day	1.
Long-Term Consequences		

Risk Factors	Risks	Mitigations
Economic Impacts	1. 98% cargo of entire island goes through entrance channel 2. From impact to action – same day 3. There is little reserve stock 4. Everyone works on Just in time and limited inventories 5. Refineries will shut down in 4 days 6. If forecasted, can ride out an inventory – hurricanes 7. Tourist traffic will be affected (arriving from air and sea)	1.
Environmental Impacts	1. Areas protected: Western side of harbor; by pier 16. 2. Endangered species – birds; fish breeding 3. San Juan Bay Estuary – EPA protected estuary 4. Turtle nesting grounds to the east	1.
Health and Safety Impacts	1. Large population around the harbor 2. Cannot evacuate them in an emergency 3. LPG in Catano 4. Trades will drive emissions to the SW.	