Port of Baltimore
Workshop Report

Introduction

A Port Risk Assessment Workshop was conducted for the Port of Baltimore, Maryland on February 21 & 22, 2001. 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
- Baltimore Port 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 waterway users/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 experts 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 normally 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, port specific 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
5.5	27.8	15.1	18.0	18.2	15.4

Analysis:

Book 1 begins the process of weighting the national port risk model. The participant teams use their knowledge and the AHP process to provide weights for the six major risk categories. The contribution to the national model by the Port of Baltimore participants is as listed above. These participants felt that Traffic Conditions 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
5.5	27.8	15.1	18.0	18.2	15.4

% High Risk Deep Draft	Volume Deep Draft	Wind Conditions	Visibility Obstructions	# of People on Waterway	Economic Impacts
0.4	2.4	2.2	3.9	5.1	2.3
% High Risk Shallow Draft	Volume Shallow Draft	Visibility Conditions	Channel Width	Volume of Petroleum	Environmental Impacts
5.1	3.6	6.3	3.9	3.5	4.0
	Vol. Fishing & Pleasure	Tide & River Currents	Bottom Type	Volume of Chemicals	Health & Safety Impacts
	7.7	2.0	2.5	9.5	9.1
	Traffic Density	Ice Conditions	Waterway Complexity		
	14.2	4.6	7.7		

Analysis:

Book 2 further refines the weighting for the national port risk model. The participants examined the importance of the 20 risk factors to port safety 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: Percent High Risk Shallow Draft Vessels tied at sixth highest risk factor with Number of People on the Waterway.
- Traffic Conditions: Traffic Density contributes the highest amount of risk, and the Volume of Fishing and Pleasure Craft tied at fourth highest with the Waterway Complexity risk factor.
- Navigational Conditions: Visibility Conditions contributes the fifth highest amount of risk.
- Waterway Configuration: Waterway Complexity tied at fourth highest risk factor as noted.
- Immediate Consequences: The Volume of Chemicals contributes the second highest amount of risk and the Number of People on Waterway tied at the sixth highest amount of risk.
- Subsequent Consequences: Health and Safety Impacts contributes the third 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	2.8
c. Severe winds are frequent & anticipated	5.0
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
Tide and River Currents	
a. Tides & currents are negligible	1.0
b. Currents run parallel to the channel	2.5
c. Transits are timed closely with tides	5.7
d. Currents cross channel/turns difficult	9.0
Ice Conditions	
a. Ice never forms	1.0
b. Some ice forms-icebreaking is rare	2.3
c. Icebreakers keep channel open	5.5
d. Vessels need icebreaker escorts	9.0
Visibility Obstructions	

a. No blind turns or intersections	1.0
b. Good geographic visibility-intersections	2.0
c. Visibility obscured, good communications	4.6
d. Distances & communications limited	9.0

Channel Width

a. Meetings & overtakings are easy	1.0
b. Passing arrangements needed-ample room	2.2
c. Meetings & overtakings in specific areas	5.6
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	1.7
c. Mud, sand and rock outside channel	4.7
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	2.8
c. Converging - NO crossing traffic	4.9
d. Converging WITH crossing traffic	9.0

Number of People on Waterway

a. Industrial, little recreational boating	1.0
b. Recreational boating and fishing	3.5
c. Cruise & excursion vessels-ferries	6.0
d. Extensive network of ferries, excursions	9.0

Petroleum Volume

a. Little or no petroleum cargoes	1.0
b. Petroleum for local heating & use	2.9
c. Petroleum for transshipment inland	5.2
d. High volume petroleum & LNG/LPG	9.0

Chemical Volume

a. Little or no hazardous chemicals	1.0
b. Some hazardous chemical cargo	2.4
c. Hazardous chemicals arrive daily	5.4
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	5.4
d. Vulnerable, dependent & large	9.0

Environmental Impacts

a. Minimal environmental sensitivity	1.0
b. Sensitive, wetlands, VULNERABLE	3.0
c. Sensitive, wetlands, ENDANGERED	5.9
d. ENDANGERED species, fisheries	9.0

Health and Safety Impacts

a. Small population around port	1.0

b. Medium - large population around port	2.5
c. Large population, bridges	5.3
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 1.6; 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 3.7.

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

Fleet Composition	Traffic Conditions	Navigational Conditions	Waterway Configuration	Immediate Consequences	Subsequent Consequences

% High Risk Deep Draft	Volume Deep Draft	Wind Conditions	Visibility Obstructions	# of People on Waterway	Economic Impacts
3.2	**3.5**	**2.9**	**3.0**	**3.9**	**7.1**
% High Risk Shallow Draft	Volume Shallow Draft	Visibility Conditions	Channel Width	Volume of Petroleum	Environmental Impacts
4.1	**4.6**	**2.3**	**3.3**	**4.8**	**8.1**
	Vol. Fishing & Pleasure Craft	Tide & River Currents	Bottom Type	Volume of Chemicals	Health & Safety Impacts
	6.4	**2.6**	**2.6**	**4.0**	**5.1**
	Traffic Density	Ice Conditions	Waterway Complexity		
	6.0	**3.8**	**6.0**		

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 safety in the Port of Baltimore (in declining order of importance):

1. Environmental Impacts (8.1)
2. Economic Impacts (7.1)
3. Volume of Fishing and Pleasure Craft (6.4)
4. Waterway Complexity (6.0)
5. Traffic Density (6.0)
6. Health & Safety Impacts (5.1)

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

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

% High Risk Deep Draft		Volume Deep Draft		Wind Conditions		Visibility Obstructions		# of People on Waterway		Economic Impacts	
11	0.4	**17**	-0.1	**18**	-0.2	**14**	0.0	**12**	0.3	**2**	1.9
RA		RA		RA		RA		RA		OTH	ALERT
% High Risk Shallow Draft		**Volume Shallow Draft**		**Visibility Conditions**		**Channel Width**		**Volume of Petroleum**		**Environmental Impacts**	
9	0.4	**13**	0.1	**20**	-0.3	**14**	0.0	**7**	0.5	**1**	2.7
RA	ALERT	RA		RA		RA		RA		OTH	ALERT
		Vol. Fishing & Pleasure Craft		**Tide & River Currents**		**Bottom Type**		**Volume of Chemicals**		**Health & Safety Impacts**	
		4	1.0	**16**	-0.1	**19**	-0.2	**10**	0.4	**6**	0.8
		RA	ALERT	RA		RA		RA		RA	
		Traffic Density		**Ice Conditions**		**Waterway Complexity**					
		5	0.8	**7**	0.5	**3**	1.5				
		RA		RA		RA	ALERT				

KEY					
Risk	RA	Risk Acceptable	DI	Improve Dynamic Navigation Info
	AN	Improve Aids to Navigation	VTIS	Vessel Traffic Information System

Factor	
Rank	Risk Gap
Tool	ALERT

CM	Improve Communications	VTS	Vessel Traffic System
RR	Improve Rules & Regulations	OTH	Other – not a VTM solution
SI	Improve Static Navigation Info		

Legend:

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.

Analysis:

The results shown are consistent with the discussion that occurred about risks in the Port of Baltimore. For each of the 15 risk factors for which there was good consensus, the participants judged the risk to already be at an acceptable level due to existing mitigation strategies. The participants suggested VTM tools were appropriate for:

- % High Risk Shallow Draft Vessels – RA (6), RR (5), OTH (2)
- Volume of Deep Draft Vessels – RA (11), AN (1), VTIS (1)
- Volume of Shallow Draft Vessels – RA (10), RR (3)
- Traffic Density – RA (8), RR (3), VTIS (1), OTH (1)
- Tide & River Currents – RA (12), DI (1)
- Ice Conditions – RA (8), AN (2), OTH (3)
- Visibility Obstructions – RA (10), AN (2), SI (1)
- Channel Width – RA (8), SI (1), OTH (4)
- Number of People on the Water – RA (10), RR (3)
- Volume of Petroleum – RA (10), RR (1), VTIS (2)
- Volume of Chemicals – RA (9), RR (2), VTIS (2)
- Health & Safety Impacts – RA (9), CM (1), OTH (3)

No consensus alerts occurred for the following risk factors because team votes were split between several VTM tools, as indicated:

- % High Risk Shallow Draft Vessels – RA (6), RR (5), OTH (2)
- Volume of Fishing and Pleasure Craft – RA (6), RR (6), OTH (1)
- Waterway Complexity – RA (4), RR (2), DI (3), VTIS (3), OTH (1)
- Economic Impacts – RA (3), RR (3), DI (1), OTH (6)
- Environmental Impacts – RA (4), RR (3), DI (1), OTH (5)

Summary of Risks

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

- The Chesapeake Bay and its tributaries from Annapolis, Maryland to the Chesapeake & Delaware Canal including the upper Potomac River.

FACTOR	RISKS	RISK MITIGATION STRATEGIES
Fleet Composition		
Percent High Risk Deep Draft Cargo & Passenger Vessels	**Today:** • Less than 20% of the deep draft vessels are high risk. • The Port's competitive focus has been on RORO, and also as a niche port for automotive shipments. These ships characteristically have a very high freeboard/sail area. • PSC boardings show that break bulk sugar boats (because of their less competent crews and poorer vessel condition), and the Russian ships carrying aluminum ingots (because of their lack of English proficiency and refusal to listen to directions) tend to be higher risk ships. Ships with Indian crews are coming in at Sparrows Pt. and also seem to have more problems – The consequences of casualties with these vessels is lower because they are not carrying hazardous cargo. • Baltimore had been a petroleum port; now the Apex dock is used once a month by ships that are better than the sugar and aluminum carriers. • RORO ship's ramps don't get much maintenance except in drydock. Burst hydraulic hoses result in spills. • There have been instances of ships loosing power while docking; 3 at the Apex pier, and two at the S. T. dock. **Trends:** • Quality of the ships is getting better. • Foreign crews are not getting better. Their lower competency is exacerbated by the mix of nationalities & languages.	**Existing Mitigations:** • Port State Control efforts are resulting in better quality ships. • Coal ships well maintained. • Insurance requirements require certain levels of ship quality be maintained in order to continue carrying cargoes for a longer period of time. **New ideas:** • None discussed

FACTOR	RISKS	RISK MITIGATION STRATEGIES
Fleet Composition (continued)		

FACTOR	RISKS	RISK MITIGATION STRATEGIES
Percent High Risk Shallow Draft Cargo & Passenger Vessels	**Today:** • Tugs & tows transiting the port from other regions not familiar with local conditions. • Spills are related to topside operations vs. whether single or double-hulled barges are used. • Tolchester Channel has a history of ships getting out of channel. • Many recreational boaters do not have sufficient education or boating safety knowledge. – Pleasure boaters don't understand dynamics of large ship and tug operations, causing operators to operate differently such that the ship is endangered. – PWCs are 12% of registrations (13,000) and are involved in 37% of accidents. – Governments receiving more requests for speed limits generally driven by jet ski abuses and bank erosion caused by pleasure craft wakes. • High percentage of small boats on the Patapsco River are poorly maintained and overloaded. • 20-30% of accidents are directly related to alcohol. Annual Maryland statistics show 12 fatalities and 300 total accidents. • Interaction of rowing shells with other traffic on the upper Potomac and in Baltimore at Ft. McHenry is a real hazard. These boats have no freeboard and swamp easily. • Commercial operators concerned that small boats have trouble seeing at night. • High performance boats have greatly increased in number. Generally have been safe but are going very fast. **Trends:** • None discussed.	**Existing Mitigations:** • Baltimore/Chesapeake Bay is a large waterway that is in general suitable for safe use by mixed marine traffic. • Double-hulled barges specifically used on the Wicomico River to reduce the risk of spills. • PWC use was banned on the Wicomico River because of hazardous conflicts with other vessels. • CG voluntary courtesy marine exams of F/V, recreational boats and other un-inspected vessels. **New ideas:** • None discussed

FACTOR	RISKS	RISK MITIGATION STRATEGIES
Traffic Conditions		
Volume of Deep Draft Vessels	**Today:** • There are about 4,000 deep draft transits per year **Trends:** • Deep draft volume had been going down until about three years ago and now seeing a slight increase. Decision by one company to make this a hub will result in a 10-15% increase in deep draft traffic.	**Existing Mitigations:** • Dredging operations in process or planned for the immediate future are improving the channels and expanding the anchorages. • There is plenty of room in the waterway to support present volume and future increased ship traffic. • The port has reduced the turn-around times for ships to discharge cargo through improved handling technologies. • Anchorages are crowded. • Navigation is made safer by a voluntary VTIS located in the lower bay. Pilots stay in communication by radio and cell phone once they leave that system. – AIS equipment in the pilot's tower at Cape Henry; transponders will be in place by next year (to international standard) thus expanding the VTIS. – Pilots carry DGPS aboard with them. • USACE controls ship movement through the C&D Canal. **New ideas:** • None discussed

FACTOR	RISKS	RISK MITIGATION STRATEGIES
Traffic Conditions (continued)		
Volume of Shallow Draft Vessels	**Today:** • Commercial fishing fleet is diminishing. Concentrated activity from June through August for crabbing. Was up to 8,000 boats. Now as few as 4,300 on the Bay. • Dinner cruise ships operate in Baltimore and Annapolis harbors as well as between those two ports and up the Severn River. **Trends:** • Dinner cruise fleet increasing • Tug and barge traffic is increasing slightly, but industry is not sure that it will remain so. • Coast Guard is reviewing a greater number of vessel construction plans indicating a growing trend.	**Existing Mitigations:** • Waterway can handle volume **New ideas:** • None discussed

FACTOR	RISKS	RISK MITIGATION STRATEGIES
Traffic Conditions (continued)		
Volume of Fishing & Pleasure Craft	**Today:** • Waterway conflicts occur on weekends with high recreational boat use. • Over 200 special events April through October. CG permits ~ 120 annually. • Problem areas: – Concentration of recreational boats fishing/sailing at the Bay Bridge leading to ship/boat conflicts. – The rivers are saturated with boat traffic. – At Mattawoman / Dundee Cr. extra parking and ramps were added for the bass tournaments (26 per year) with 150 boats each. – Greatly increased boat use on the Potomac River. – Hart-Miller Island a popular destination – Annapolis & Baltimore harbors, Severn, Gunpowder, South and Middle rivers have exceeded capacity of the waterway. – Dock-bars at Middle River and Solomon's Is. – Offshore power boat race created a monster headache for ships that had to delay transits. – Whitbread race two-week event from Baltimore to Annapolis. • Inner harbor development increased Baltimore marina capacity 3 times more over 15 years on the upper Patapsco R. and is moving out toward the marine terminals. **Trends:** • Boat registrations increasing 5% overall annually; boats are also larger. • A Federal program will add transient docking facilities for 26 foot boats • Watertrails Program encouraging the use of kayaks.	**Existing Mitigations:** • Maryland state boating safety activities – Regulations and law enforcement agencies; management plans addressing boat speed on specific waterways. – Educational program is robust, and enrollment in it is up – State private aids to navigation system primarily for recreational boaters in joint jurisdictional waters. • Coordination and cooperation of state and federal maritime safety resources. • Special local regulations issued to control some events. **New ideas:** • Deep draft vessels need help around the Bay Bridge for navigation on weekends. CG, CGAUX, or some other L/E presence to patrol the area. • Write & publish articles and pictures in Maryland papers and TV during spring and summer months concerning problems caused by irresponsible recreational boaters.

FACTOR	RISKS	RISK MITIGATION STRATEGIES
Traffic Conditions (continued)		
Traffic Density	**Today:** • Summer weekends are the only problem. • Tuesday sailboat race at Seagirt impedes deep draft traffic in the channel. • Conflict of various small boat users vs. ships at the mouth of C&D Canal. • Fishermen gathered around buoys obscure them. • Mix of small boats, paddle boats, etc at Baltimore's inner harbor, but ships don't go there often. **Trends:** • None discussed	**Existing Mitigations:** • COLREGS, when known and followed. • In Maryland anyone born after July 1, 1972 must have taken a boating safety education course. Not yet showing an impact on incident / accident rates. • Targeted L/E specific to a known event. • Good VHF-FM communications. **New ideas:** • Licensing of pleasure craft operators. • Changing the mindset of boaters about their freedom of activity on the water. • Add boater education pamphlets to the state's registration renewal letters. • Explicit standards of operation for L/E officers to enforce, such as: specified distances from vessels. State or port supported laws, or, amend Inland Waterway Rules. • Ship or barge operators submit visual documentation to the CG for subsequent Negligent Operations citations of recreational boaters.

FACTOR	RISKS	RISK MITIGATION STRATEGIES
Navigation Conditions		
Wind Conditions	**Today:** • Car carriers going to the Atlantic and Toyota (Fairfield) berths are hit by cross winds while docking. • Usually 30 knot winds cause greater concern for deep draft. These conditions are experienced about 4-5 days per week in the winter and spring. • Wind direction impacts the water level in the Bay greatly, and can lead to groundings. – Winter wind is generally NW (11-12% of the time). • Ships can operate satisfactorily in up to 30-knot wind in Brewerton Eastern Extension Channel. • Small boats experience trouble in as little as 15 knots in Gunpowder River's narrow channel. • Port lacks adequate tugs with the horsepower to handle all ships under all conditions. • Forecasts are seen as lacking accuracy. **Trends:** • None discussed	**Existing Mitigations:** • Physical Oceanography Real-Time System (PORTS) installed in many locations. Accessible via cell phone or web site. **New ideas:** • None discussed.

FACTOR	RISKS	RISK MITIGATION STRATEGIES
Navigation Conditions (continued)		
Visibility Conditions	**Today:** • Significant fog of any duration is seen perhaps 10% of the year. – Usually the whole Bay socks in. – Often 100-200 foot visibility. • "Product fog" from the Millennium Plant limits vision at the Key Bridge. • Thunderstorms can bring trouble with high winds, hail; pleasure boaters rush to harbor • Ice fog in winter is a problem. 1977-78 ice conditions caused a 10 ft deck of fog (& moved the buoys); that was a real navigation problem. **Trends:** • None discussed	**Existing Mitigations:** • Pilots wait out thunderstorms' passage. • Unusual to have zero visibility in Baltimore harbor. • Electronic navigation aids plentiful and reliable. **New ideas:** • None discussed

FACTOR	RISKS	RISK MITIGATION STRATEGIES
Navigation Conditions (continued)		
Tide & River Currents	**Today:** • Tidal currents run at 1 knot generally. • The convergence of Bay tides, Potomac River currents and wind-driven seas can make the area at Point Lookout a significant hazard for small boats. • Kent Narrows, and Knapps Narrows on Tilghman Island have a high current; can cause problems for small craft. • Water releases from the Susquehanna River cause high currents affecting small boats. • Tugs must time the tides for depth of water on the Wicomico for delivery of heating fuels needed in Salisbury and the Eastern Shore. • Brewerton Eastern Extension Channel has a 2-knot cross channel current that suddenly disappears once a ship has crossed it. • Tankers have trouble transiting at Sparrows Point. **Trends:** • None discussed	**Existing Mitigations:** • Bay harbors generally don't have much current. **New ideas:** • None discussed

FACTOR	RISKS	RISK MITIGATION STRATEGIES
Navigation Conditions (continued)		
Ice Conditions	**Today:** • Every 3-4 years there is some heavy demand for icebreaking for barge and deep draft traffic, but ice really affects larger ships about every 10-12 years. • Really serious ice build-ups usually stop at the Patapsco River. • Ice in the mid to upper Chesapeake Bay primarily impacts shallow draft vessels every season. • Ice may raft up to 6+ feet thick, especially in Tolchester Channel. • USACE has a dredging window of October through March to deposit spoils on Hart-Miller Island that can be interrupted by ice conditions. • Ice conditions are harsh enough about every 2 years to affect buoys. • Ice buoys may be pushed under the ice for a long period. • Aids to navigation off the main channels may not be repaired for up to 6 months after a heavy ice season. • Icebreaking assets are not available to operate in a winter like 1993-94. • CG has ice-capable ships vs. icebreakers. The 175 foot buoy tenders have the power, but are untested in heavy ice over a long period of time. • Number of assets available to break ice can affect fuel delivery to power plants with a rippling affect on delivery to New England also. • Ice conditions may also affect the changing over of pilots for C&D canal. • Commercial fishing fleet rarely needs to wait a day for State-operated icebreaker services. **Trends:** • None discussed	**Existing Mitigations:** • Ice breaking resources are relocated to permit response to need. **New ideas:** • None

FACTOR	RISKS	RISK MITIGATION STRATEGIES
Waterway Configuration		
Visibility Obstructions	**Today:** • The Ft. McHenry range light is obscured by vegetation and background lighting. • Shoreside development is moving outward from Baltimore inner harbor and brings with it interfering background lighting. • Small aids are obstructed from view at Lazaretto Point. • Blind spots for approaching traffic at North Point and Sparrows Point • Vessels downbound on the Anacostia River cannot see aids obstructed by Reagan National Airport lights. • Practice-field lighting at the Naval Academy is blinding for Severn River traffic. • Trees and vegetation obstruct Old Field Point range off the centerline. • Background lights obstruct Curtis Bay range. The problem is compounded by a 90 degree turn and bridges that obscure traffic on the other side. • Aberdeen, Patuxent Naval Air Station and Dahlgren ordnance ranges close the waterway by day. Watermen then work at night, therefore increasing their risk of operation. • Sparrow Pt. ore pier channel light is obscured by overhead lighting on pier. **Trends:** • None discussed	**Existing Mitigations:** • None discussed **New ideas:** • None discussed

FACTOR	RISKS	RISK MITIGATION STRATEGIES
Waterway Configuration (continued)		
Channel Width	**Today:** • Recreation boat channels are generally narrower (Kent Narrows, Shallow Creek, Gunpowder River, Upper River and Patapsco Rivers are examples). • Ferry Bar Channel, Curtis Bay Channel, and Brewerton East Extension Channel are narrow for deep draft ships. • Turning operations at Sparrows Point must be conducted without any other traffic transiting the channel. • Floating debris obstructs and effectively narrows channels. • Crab pots and gill nets encroach upon the channels at Tilghman Island. **Trends:** • None discussed	**Existing Mitigations:** • Communications and coordination between pilots. • USACE requires one-way traffic in C&D canal if the combined beam of ships will exceed 190 feet. • The approach channel for the Toyota pier is being widened. • Pilots will not meet with deep draft ships in Brewerton Eastern Extension Channel and Ferry Bar Channel. **New ideas:** • None discussed
Waterway Configuration (continued)		
Bottom Type	**Today:** • Mostly silt and mud bottom throughout the Baltimore / Chesapeake Bay area. • The shoal between Ferry Bar Channel and Baltimore is hard ground. • A USCOE pipeline for dredge material is located at Perch Cove. • C&D Canal is lined by riprap. York Spit Channel is hard bottom, and when Upper Craighilll Channel was dredged to 50+2 they found hard ground. **Trends:** • None discussed	**Existing Mitigations:** • Soft bottom in general. **New ideas:** • None

FACTOR	RISKS	RISK MITIGATION STRATEGIES
Waterway Configuration (continued)		
Waterway Complexity	**Today:** • Brewerton East Extension Channel at Town Point has hard turns both east and west. • Turn into Curtis Bay is sharp, but ships are small enough that its not a problem. • BMI shipbuilding at Sparrows Point has a private channel with federal aids. Transit requires local knowledge & is used by 1,000-foot ships. • Intersecting traffic at Brewerton and Tolchester and Swan's Point channels requires planning. • Dredging operations also increase the complexity of navigation throughout the port area. • Water taxis criss-cross channels inside of Baltimore's Lazaretto Point. • Sailboats are always crossing channels. • North to south crossing of C&D Canal by a water taxi. • Hydrilla water plants in the Potomac River can affect navigation of recreational boaters and can cause ships to lose cooling water. • White Haven, Woodland and Trent Avon ferries cross channels. • Kent Narrows dogleg is a blind passage through two bridges. A mad rush of uncontrolled boat traffic ensues when the bridge is opened. State highway administration controls the bridge but will not take risk of liability by controlling traffic. **Trends:** • Constant dredging and channel maintenance by the USACE will continue. • High-speed ferry on the Potomac River is under consideration for future use.	**Existing Mitigations:** • Great charts and aids to navigation systems. • Friendship & cooperation of federal and state agencies with the maritime community. • Straightening of Tolchester Channel • Widening of the Brewerton Eastern Extension Channel • Bridge-to-bridge communications and the pilot operated VTIS in the lower Bay. • P.O.R.T.S. (water level and some meteorological observation sites) in the Bay is working • DGPS and electronic charting systems improve navigation accuracy. • Pilots carrying laptop DGPS systems. • USACE dredging projects and channel surveys. • Local knowledge of professionals. • All deep draft ships carry pilots. Many out-of-town tugs will also take a pilot. • Pilots will have AIS equipment on-line soon. GPS transponders also coming. • Two-hour ship clearance for C&D Canal transits allows safer passages. • Airgap measuring system for C&D Canal bridge clearances. • Development of new Baltimore harbor anchorages and turning basins. **New ideas:** • Small navigation projects need increased emphasis.

FACTOR	RISKS	RISK MITIGATION STRATEGIES
Immediate Consequences		
Number of People on Waterway	**Today:** • Baltimore dinner cruise ships carrying 24 –175 passengers each. These go to the Key Bridge, some go to Annapolis. • Three DC dinner cruise boats carry up to 149 passengers each. • Dinner cruises up the Severn River in Annapolis. • 12-27 deep draft cruise ship visits expected per year with from 125 up to 2,000 passengers (QE II example) • Bloody Point to Bay Bridge is carpeted with sailboats. Annapolis sailboat races draw large fleets with little regard for commercial traffic safety. • Liberty ship John Brown makes cruises about 6-8 times per year carrying up to 1,000 people. • American Cruise lines coming to Baltimore. **Trends:** • Increasing numbers of vessels.	**Existing Mitigations:** • None discussed **New ideas:** • None discussed

FACTOR	RISKS	RISK MITIGATION STRATEGIES
Immediate Consequences (continued)		
Volume of Petroleum Cargoes	**Today:** • Most petroleum cargo goes to Apex and ST terminals in Baltimore. • Normal loads are about 300-400,000 bbls. • There is a new terminal for asphalt at Curtis Bay. • Renewal and expansion of the Motiva petroleum facility is underway in Baltimore Harbor. • Approximately 3 bulk barges monthly and 8-10 deep draft tankers per month. • Also bunkering 3 ships weekly in Baltimore harbor at anchorages. Approximately 3 navy vessels are bunkered at the Naval Academy each month. • Between 6-10 bunkering notifications made to the Coast Guard per week overall. **Trends:** • Transits of barges between Philadelphia and Baltimore are increasing. • A LNG facility proposed for 2002 at Cove Point.	**Existing Mitigations:** • None discussed **New ideas:** • None discussed

FACTOR	RISKS	RISK MITIGATION STRATEGIES
Immediate Consequences (continued)		
Volume of Hazardous Chemical Cargoes	**Today:** • 2-3 sulfuric acid deliveries made by barge to Curtis Bay daily. • 2-3 tankers into Baltimore monthly carrying up to 25 different chemicals each. • 3 deliveries monthly by barge of black oil to Georgetown waterfront in Washington in 10-15,000 bbls loads. • 3 barges per month of ammonium nitrate to Salisbury. • USACE shows that 3% of total tonnage is in chemicals. • Container ships carrying hazardous materials losing vans (M/V Santa Clara example) 7-9 % containerized hazmat. **Trends:** • None discussed	**Existing Mitigations:** • None discussed **New ideas:** • None discussed

FACTOR	RISKS	RISK MITIGATION STRATEGIES
Subsequent Consequences		
Economic Impacts	**Today:** • The ILA works 2 million man-hours in support of commercial activity in the port. • $6-7 million per day would be lost or deferred with any port closure. • The Governor's Task Force found that local salvage vessels are not sufficient to mitigate a port closing caused by a grounded vessel. Closest commercial resource is in New York about 2 days away; or perhaps Norfolk Navy salvage equipment. – Tugs must come from Philadelphia, 8-9 hours away, to resolve less severe ship groundings. • Impact from a sudden closure begins immediately, affecting the maritime community servicing the port. Most carriers will look for alternative ports if the closure is greater than 72 hours, and it increases their costs significantly. • Closed shellfish beds impact the fishing community immediately and with a longer-lasting public perception. – Grounding on an oyster bed can eliminate the bed forever. • A natural resource damage assessment can result in unlimited liability to polluters in addition to the cleanup costs. These are significant economic impacts. • Baltimore's planning commission can't control all the growth activity, and consequently its impact upon the port. • Lightering facilities are not immediately available in the port area. **Trends:** • None discussed.	**Existing Mitigations:** • A USACE obstruction study resulted in estimate of 2-4 days to dredge a side channel around a grounded ship. • Two routes into and out of the port area help mitigate economic risks. • Availability of rail, truck and pipelines mitigates blockage of materials' flow out of the port. • MPA maintains a constant action plan to mitigate risks. • The Washington, DC fireboat is aged, but capable. • Port closures for races allow sufficient notice for planning to minimize economic impacts. **New ideas:** • MPA looking at risks associated with conflicts between recreational and commercial maritime interests. • Replace the Baltimore City fireboat.

FACTOR	RISKS	RISK MITIGATION STRATEGIES
Subsequent Consequences (continued)		
Environmental Impacts	**Today:** • Very high concern for environmental affects throughout the Chesapeake Bay and Potomac River. Wetlands, estuaries, breeding grounds are highly vulnerable. • The effects of a pollution incident also depends on the time of the year and material spilled. • Scientists are unable to assign priorities within the region because everywhere is so sensitive. • Eagles breed at the Aberdeen Proving Ground. Floods float barrels into the area with pollutants in them. No one really knows what's on the grounds. Estimates range from 3-30 million rounds of unexploded munitions. • There is an environmental focus on Smith and Tangier Islands. • A Governor's Task force identified that oil spill response command and control and planning were weak. – Response capabilities tested by the PEPCO spill showed chaotic response. • OPA 90 planning in this area is far behind the West Coast in numbers of planners and commitment by the states. **Trends:** • None discussed	**Existing Mitigations:** • OPA 90 requires planning and assessments of most significantly sensitive areas • Regional fire boats assigned • Pre-positioned equipment and contract cleanup arrangements; exercises both planned and unannounced. • Regional response teams are organized. • Mid-Chesapeake Marine Emergency Response Group's participating agencies pushing for & coordinating resources. Agencies coordinate through CG Activities Baltimore. **New ideas:** • Standard communications frequencies and or equipment for cross-agency communications. All marine units have VHF-FM. • Incident Command System is there but needs additional work to be fully effective. • AIS repeaters needed at Cape Charles and another place TBD.

FACTOR	RISKS	RISK MITIGATION STRATEGIES
Subsequent Consequences (continued)		
Health & Safety Impacts	**Today:** • Calvert Cliffs nuclear power plant is located near Solomon's Island. • The population in the port area is about 2.5 million people. • Most drinking water is drawn from reservoirs except for that which comes from intakes above Great Falls on the Potomac River. – Cooling water is drawn from Morgantown (Route 301 bridge). • There are cooling water intakes outside the Key Bridge. **Trends:** • None discussed	**Existing Mitigations:** • None discussed **New ideas:** • None discussed

Additional Risk Items:

- Baltimore city radio interference with VHF-FM.
- Bay swims and amphibian (DWK) boats present additional hazards at a low occurrence rate.
- Ch 16 congestion is a problem on weekends and reflects the Volume of Fishing and Pleasure Craft.
- CG issued a notice that they do not monitor CH 9. But the public is encouraged to move routine talking to Ch 9. This may result in missed distress calls.

Summary of Port of Baltimore Waterway Navigational Attributes

- ***Ship Channel Complexity:*** Long channels to the port from north and south; ocean entrance channel with cross-currents and potentially high wave action; cross currents in several channels (Cape Henry, Rappahannock Shoal, Brewerton Channel Eastern Extension).

- ***Converging or Crossing Traffic:*** Converging traffic at Cape Henry from north and southbound ocean sea lanes; York Spit Channel and York River Entrance, Craighill Entrance, junction of Cutoff Angle and Brewerton Extension, junction of Ft. McHenry, Curtis Bay and Ferry Bar Channels, and junction of main channels with branch channels and anchorages.

- ***Ship Channel Configuration:*** Federal project depths are 50 feet in the main channel between the Virginia Capes and Fort McHenry, Baltimore, thence 42 feet in Ferry Bar Channel (east section); thence 49 feet in Northwest Harbor East Channel turning basin; thence 50 feet in Northwest Harbor West Channel and turning basin; and 50 feet in Curtis Bay Channel. The Federal project in the main channel between the Delaware Capes and Baltimore via the C & D Canal is 35 feet.

- ***Recreational and Local Fishing Activity:*** Seasonally larger numbers of recreational boat and personal water crafts all year; nearly a quarter million are registered in the bay area. Approximately 4,300 commercial fishing vessels are registered in Maryland.

- ***Bottom:*** Soft, silted bottom. Formerly the Susquehanna River Basin.

- ***Currents:*** Currents in the port area are 0.8 knots on the flood and ebb; mean tidal range is 1.1 feet. Cross currents in several channels (Cape Henry, Rappahannock Shoal, Brewerton Channel Eastern Extension).

- ***Wind:*** Winter and spring have the highest average wind speeds.

- ***Visibility:*** Generally good, though fog occurs chiefly from October to March. From April to September there are only a few days with dense fog and very light winds clear the fog away.

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

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

- Lighted & Unlighted – Fixed & Floating: USCG combination of all. Also Maryland and private.
- Electronic Aids: GPS, RACON, LORAN C
- Traffic Separation Schemes: None
- Regulated Navigation Areas (RNA): No permanent RNAs in effect

- ***Vessel Traffic Systems (VTIS/VTS)***

- Baltimore Marine Exchange "Port Communications Cooperative"

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

- Own Ship's & Other Ship's Position: Situational awareness derived by Bay / Docking pilot communication between vessels, visual & radar observation by the pilot.
- Other Ship's Intentions: Through pilot radio communication with other vessel's pilot and through the pilot's dispatcher.
- Waterway configuration: See converging or crossing traffic chart
- Environmental conditions: None. ACP?

Port of Baltimore
Planned and Anticipated Changes

- ***Planned Infrastructure Developments:*** Widen western 5 miles of Brewerton Channel Eastern Extension from 450 to 600 feet wide. Due March – June 2001. Straighten Tolchester Channel S-Turn – due October – March 2001. Construct 1200 x 1200 foot turning basin at the head of Ft. McHenry Channel. Widen East Dundalk Marine Terminal Channel from 300 to 400 feet wide. Construct a 2,200 foot square and 42 foot deep anchorage in anchorage No. 3. Construct a 1,800 foot square and 42 foot deep anchorage in Anchorage No. 3. Construct a 1,800 square foot and 35 foot deep anchorage in Anchorage No. 4. Construct a loop channel 36 feet deep at South Locust Point Marine Terminal due September 2001 to March 2003.

- ***Changes in levels and/or nature of waterway activities:*** Progressive increase in marine events.

- ***Forecast Traffic Levels****:* Gradual decline from 1995 to 1999, but generally stabile

- ***USCG Regulations to be implemented:*** Possible implementation of a restricted access area or RNA in the vicinity of Cove Point with planned reactivation of LNG facility in 2002. Possible reinstitution of a seasonal regulated navigation area in the upper Chesapeake Bay to coincide with the ice seaason.

- ***Changes under consideration, but not committed:*** Deepening of the existing federal navigatioin channel in the Chesapeake and Delaware Canal from the Delaware River to deep water in the Chesapeake Bay off Pooles Island (35 feet deep 450 feet wide and 47 miles long) and the Baltimore Harbor connecting channels of Tolchester and Brewerton Eastern Extension (35 feet deep and 450 – 600 feet wide by 13 miles long). MPA Port land Use Development Plan