Executive Summary

The West Coast Offshore Vessel Traffic Risk Management Project was co-sponsored by the Pacific States/British Columbia Oil Spill Task Force and the US Coast Guard, Pacific Area. Rick Holly of the California Office of Spill Prevention and Response served as the Task Force co-chair. USCG Pacific Area co-chairs included CAPT Ed Page, CAPT Frank Whipple, and CAPT Glenn Anderson.

They co-chaired a workgroup of representatives of the following interests: the oil spill agencies in Alaska, Washington, Oregon, and California, and the Province of British Columbia; the US Coast Guard Districts 17, 13, and 11; the Canadian Coast Guard, Pacific Region; NOAA (both Hazmat and National Marine Sanctuaries); Environment Canada; the US Navy; the Canadian Maritime Forces; the Cook Inlet Regional Citizens' Advisory Council; the BC Chamber of Shipping; the BC Council of Marine Carriers; the Puget Sound Steamship Operators' Association; the Puget Sound Marine Exchange; the Portland Merchants Exchange; the Port of Portland; Save Our Shores; the California Coastal Commission; the Western States Petroleum Association; the Council of American Master Mariners; the American Waterways Operators, Pacific Region; Teekay Shipping (for INTERTANKO); and the Pacific Merchant Shipping Association.

The goal of the project was to reduce the risk of collisions or drift groundings caused by vessel traffic transiting 3 to 200 nautical miles off the West Coast between Cook Inlet in the North and San Diego in the South. Vessels of concern included tank, cargo/passenger, and fishing vessels of 300 gross tons or larger. Working together from 1999 to 2002, this Workgroup collected and reviewed data on typical coastwise traffic patterns, traffic volume, existing management measures, weather data and ship drift patterns, historic casualty rates by vessel type, the availability of assist vessels, the environmental sensitivity of the coastlines, socio-economic consequences of a spill, and projections of relevant future initiatives. Using the drift and tug availability data, they modeled likely tug response times under both average and severe weather conditions.

The Workgroup then developed a Relative Ranking/Risk Indexing Worksheet that evaluated nine factors: volume of oil/vessel design; drift rates; areas of higher collision hazards; distance offshore; weather/season; tug availability; coastal route density; historic casualty rates by vessel type; and coastline sensitivity. Using this tool, they developed and ranked a total of fifty-two casualty scenarios in all the West Coast jurisdictions. These were then extrapolated into 1,296 additional scenarios on the West Coast, a modeling process which defined both average and "higher risk" areas from Alaska to California.

Workgroup members then addressed four risk factors most amenable to change; tug availability, collision hazards, historic casualty rates by vessel type, and distance offshore. They developed a set of draft findings and recommendations using the criteria that the findings and recommendations had to be supported by the data, realistic (capable of being implemented), effective, economically feasible, and flexible enough to allow for incorporation of new technology and changes in policy.

From December of 2001 through March of 2002, the Project Co-chairs, the Task Force Executive Coordinator, and Workgroup members presented these draft findings and recommendations to affected stakeholder groups and at public meetings in Alaska, British Columbia, Washington, Oregon, and California. The draft Findings and Recommendations were also available on the Task Force website. At a final meeting in April of 2002, Workgroup members agreed to the final Findings and Recommendations found in Part VI of this report. A summary of these Findings and Recommendations follows:

I. Findings and Recommendations regarding Collision Hazards on the West Coast

- Based upon increased traffic density and collision hazards at port entrances, the West Coast Offshore Vessel Traffic Risk Management Project Workgroup **recommends** that Harbor Safety Committees or their equivalents in West Coast ports continuously monitor this risk and evaluate the need for enhanced traffic safety systems at their port entrances.

- Based on their survey of coastal transits for July of 1998 through June of 1999, the West Coast Offshore Vessel Traffic Risk Management Project Workgroup **finds** that coastwise traffic density is higher along the section of the West Coast between the Strait of Juan de Fuca and Los Angeles/Long Beach than either north of the Strait or south of LA/LB. The Workgroup anticipates that the pending AIS carriage requirement, when fully implemented, could significantly reduce any collision hazard in these areas of higher traffic density. They therefore **recommend** that the maritime and towing industry operating on the West Coast consider implementing compatible Automatic Identification System (AIS) carriage in advance of the required schedule.

- The West Coast Offshore Vessel Traffic Risk Management Workgroup **finds** that different offshore ballast water exchange standards have been adopted by California, Oregon, Washington, and several Canadian West Coast ports. Although the Project Workgroup did not find that these differing standards imposed an increased risk of collision offshore, they **recommend** that the US Coast Guard, in consultation with Fisheries and Oceans Canada and Transport Canada, and consistent with IMO actions, adopt a single set of preemptive national or regional offshore ballast water exchange standards that would enhance the consistency of navigation for the purpose of ballast water exchange on the West Coast.

II. Findings and Recommendations regarding Historic Casualty Factors

- The Workgroup **finds** a heavy concentration of reported casualty positions near major ports. This may be attributed to higher traffic density in these areas, as well as to the fact that ships conduct their status review of steering and propulsion systems 12 hours prior to entering US waters. Noting that the USCG Marine Safety Office Puget Sound worked with the Puget Sound Steamship Operators Association to develop a recommended "Standard of Care" for vessels entering port, the Workgroup **recommends** adoption of a similar Standard of Care by other West Coast US ports and encourages Canadian authorities and industry to examine the applicability in Western Canadian waters as well.

- The Workgroup also **finds** that cracks and fractures in tank vessel cargo tanks were the most common type of structural failure identified in the casualty data. The Workgroup anticipates that such incident frequency will decrease as new double-hull replacements come on line for the existing Trans-Alaska Pipeline System (TAPS) fleet. The Workgroup **recommends** continued vigilant application of the Critical Area Inspection Program (CAIP) by the US Coast Guard as the TAPS fleet ages, and encourages TAPS tanker operators to consider expedited replacement schedules.

- The Workgroup **finds** that fishing vessels also ranked high in the mechanical/equipment failure category. Based upon the Workgroup's examination of existing and proposed programs sponsored by both government and the fishing industry to improve safety overall, the Workgroup **recommends** implementation of the US Coast Guard's Commercial Fishing

Vessel Safety Action Plan. The Workgroup also recognizes the State of Washington's Fishing Vessel Inspection program as a good model for fishing vessel inspections, since it focuses on reducing accidents caused by human error.

III. Findings and Recommendations regarding Rescue Tug Availability on the West Coast

- Based on a 2000-2001 inventory, the West Coast Offshore Vessel Traffic Risk Management Project Workgroup **finds** that approximately 182 ocean-going tugs operate out of West Coast "home ports. " Of these, 77 were found to be capable of severe weather rescues. The Project Workgroup further **finds** that the capability of potential rescue vessels on the West Coast has improved greatly in recent years with the construction and placement of numerous state-of-the-art tugs with greater horsepower, maneuverability and technologically advanced equipment.

- The West Coast Offshore Vessel Traffic Risk Management Project Workgroup conducted an analysis of the response times of these 77 rescue tugs from their home ports under both average and worst case wind conditions, assuming that a disabled vessel is drifting towards shore and no other means is available to stop its drift. This analysis defined response time contours under both average and worst-case wind conditions. Where the tug availability risk factor is high due to a lack of readily available severe weather rescue tugs as identified by our tug homeport analysis, the Workgroup **recommends** consideration by local jurisdictions of several measures or combinations of measures to reduce that risk, including investment in a dedicated rescue tug, creation of a stand-by tug fund, or adoption of regulations requiring rescue tug contracts held by vessel operators.

- The West Coast Offshore Vessel Traffic Risk Management Workgroup **finds** that the International Tug of Opportunity System (ITOS), which operates in the US/Canadian transboundary waters of the Strait of Juan de Fuca and Puget Sound, and which covers the coastline of British Columbia as well, provides information on the position and basic capabilities of ocean-going tugs. The Workgroup **finds** that it would be beneficial to enhance tug position and capability information coastwise. The Workgroup recognizes that International Maritime Organization (IMO) mandated AIS carriage, as well as US domestic requirements for AIS carriage, should be in place for tugs no later than 2007, or 2004 as currently proposed by the US. The Workgroup therefore **recommends** that the US Coast Guard evaluate whether the information to be available through AIS carriage will provide equivalent or better tug position and capability information than that provided by ITOS. If so, the US Coast Guard should take steps to ensure that this information on tug positions is made available to all Captains of the Port on the West Coast. If not, or if the carriage requirements are not implemented by 2007 at the latest – optimally by 2004 – we recommend that the US Coast Guard consider placing transponders on ocean-going tugs not already carrying them, and adding signal receiving stations as needed to establish a coastwise network for information on ocean-going tug locations.

IV. Findings and Recommendations regarding the Distance Offshore Risk Factor

- The West Coast Offshore Vessel Traffic Risk Management Project Workgroup **finds** that the risk of a grounding/collision generally increases the closer a vessel transits to shore. Using a relative ranking/risk-indexing model that incorporated nine risk factors the Workgroup mapped areas of higher risk along the West Coast of Canada and the United States. The resulting higher risk areas were generally 25 miles from land along the entire West Coast, except at one point off Southeast Alaska where it extended to 50 nm, off Northwest BC where the area extended to 100 nm offshore, and off Point Arguello in California where it extended to 50 nm offshore. The workgroup **finds** that vessels transiting within these higher risk areas have a greater potential for a grounding due to one or more of the risk criteria than if they transited offshore of these areas.

- The West Coast Offshore Vessel Traffic Risk Management Project Workgroup **recommends** that, where no other management measure such as Areas to Be Avoided (ATBAs), Traffic Separation Schemes (TSSs), or recommended tracks already exist, vessels 300 gross tons or larger transiting coastwise anywhere between Cook Inlet and San Diego should voluntarily stay a minimum distance of 25 nautical miles (nm) offshore. Vessels transiting short distances between adjacent ports should seek routing guidance as needed from the local Captain of the Port or VTS authority for that area. Nothing in these voluntary minimum distance offshore recommendations is intended to preclude a vessel master from taking prudent action for the safety of the vessel and its crew.

- For the sake of consistency with existing agreements, the Workgroup further **recommends** that, where no other management measures such as ATBAs, TSSs, Tanker Exclusion Zones, or recommended tracks already exist, tank ships laden with crude oil or persistent petroleum products and transiting coastwise anywhere between Cook Inlet and San Diego should voluntarily stay a minimum distance of 50 nm offshore. Nothing in these voluntary minimum distance offshore recommendations is intended to preclude a vessel master from taking prudent action for the safety of the vessel and its crew.

- The Workgroup further **recommends** that these voluntary minimum distances offshore be communicated to mariners by placing the text of these recommendations in the Coast Pilot and Sailing Directions for the West Coast, and also by placing notes on the appropriate nautical charts, to be repeated at headlands, which indicate the voluntary minimum distances offshore and refer the mariner to the Coast Pilot and Sailing Directions for further details.

- Regarding the areas where the Higher Risk zones go beyond 25 nm, the West Coast Offshore Vessel Traffic Risk Management Workgroup **finds** that various factors mitigate the risk in these areas. For instance, the coastal transportation trade along British Columbia and SE Alaska is primarily by tug and tows. A number of powerful potential "rescue tugs" are frequently transiting through these areas as a result of this unique trading pattern. These transiting tugs supplement the rescue tugs located in homeports as used in this study. In addition, many of these coastal trading tugs are powerful long distance tugs that report in to Canada's MCTS (VTS) and/or are equipped with transponders that enhance their identification as possible rescue tugs. For the area off Point Arguello, the Workgroup finds that the northbound lanes of the Traffic Separation Scheme to/from Los Angeles/Long Beach captures this traffic.

V. Findings and Recommendations regarding Data Improvements

- The West Coast Offshore Vessel Traffic Risk Management Project Workgroup **finds** that, due to the configuration of the databases currently in use by US and Canadian federal agencies, information on cause and outcome of casualties is difficult to extract. The Workgroup notes that the US Coast Guard and the Canadian Transportation Safety Board are revising their vessel casualty databases, and **recommends** that they redesign these systems to allow for improved access to information on both the causes and outcomes of reported incidents. The Workgroup further **recommends** that the member agencies of the Pacific States/British Columbia Oil Spill Task Force implement their agreement to include causal information in their oil spill incident databases and to share that information on a coastwise basis.

- ❈ The Workgroup also **recommends** that the US and Canadian Coast Guards work with the West Coast states and maritime industry to further investigate the causes of past vessel incidents and casualties on the West Coast over a period of not less than five years.

- ❈ The West Coast Offshore Vessel Traffic Risk Management Project Workgroup **recommends** that the US and Canadian Coast Guards coordinate with marine exchanges and other appropriate organizations to improve coast-wise data collection procedures covering vessel movements in order to provide more detailed and standardized information regarding vessel types, cargo, routing, and ports of origin. Future implementation of AIS carriage should be evaluated as a potential source of data for this purpose.

VI. Recommendation regarding Implementation Review

- ❈ The West Coast Offshore Vessel Traffic Risk Management Project Workgroup **recommends** that the Pacific States/BC Oil Spill Task Force work with the US and Canadian Coast Guards in 2007 to review the status of implementation and efficacy of the final recommendations from this project.

Part I. Introduction and Project Background

The West Coast Offshore Vessel Traffic Risk Management (WCOVTRM) Project was initiated by the States/British Columbia Oil Spill Task Force. The Members of the States/British Columbia Oil Spill Task Force are the directors of the state or provincial environmental agencies with oil spill regulatory authority in Alaska, British Columbia, Washington, Oregon, and California. Based on their concerns that the routes used by both tank and non-tank vessels transiting the Pacific Coast could pose a risk to sensitive coastal resources from oil or hazardous cargo spills caused by drift groundings, the Task Force Members approved undertaking what they initially termed a "Vessel Routing" project in their 1994-1999 Strategic Plan, then reaffirmed their commitment to the project each year thereafter. However, between 1994 and 1996, the Task Force delayed forming a project workgroup while it tracked three US Coast Guard studies relevant to this issue. A summary of these studies follows:

1. *Evaluation of Oil Tanker Routing per Section 4111(b)(7) of OPA 90*, published in 1995, addressed only tanker traffic, not barges and large vessels carrying substantial amounts of bunker fuel, although the Coast Guard acknowledged the risk presented by these sources in the report. Moreover, the study of sensitive resources was limited to the West Coast including Washington, Oregon, and California. While tanker traffic originating in Alaska was included in the analysis, risks to the Alaskan shorelines were not. Furthermore, the study was silent as to the large expanse of Canadian coastline between Alaska and Washington. Study findings related to risks associated with vessel types included the following:

- "...oil tankers operate in or near the most sensitive marine resource areas. However, tankers carrying crude oil and petroleum products represent only a small percentage of the deep-draft vessel traffic that poses an oil spill threat to the most sensitive marine resources...In fact, approximately half of the spills in the Pacific EEZ have historically been from vessels other than tankers."
- "Tankers carrying crude oil or petroleum products represent only 18% of the total deep-draft vessel and barge transits that threaten oil spill damage to sensitive marine resources."
- "Non-tank vessels accounted for 53% of oil spills in the Pacific EEZ study area and 19% of total oil spilled there during the past 30 years..."

The study concluded that "This report makes no recommendation for designating tanker free zones because tankers are not the sole oil spill threat to the most sensitive marine resources."

2. The *San Francisco/Santa Barbara Port Access Route Study* evaluated existing vessel routing measures to determine if they are sufficient to address navigational safety issues and environmental concerns. The Ports and Waterways Safety Act requires the US Coast Guard to conduct such a study prior to any proposals to amend existing Traffic Separation Schemes (TSS). The study focused exclusively on the California coast. Findings included:

- The southern approach lanes of the TSS off San Francisco should be shifted seven miles seaward;
- The existing TSS in the Santa Barbara Channel should be extended from Point Conception to Point Arguello;
- A precautionary area should be established at the northwest end of the Santa Barbara Channel TSS; and
- The remaining TSS approach lanes, precautionary areas, areas to be avoided, and the shipping safety fairways within the study area should remain as configured. No navigational need for additional offshore routing measures was identified.

3. The National Oceanic and Atmospheric Administration (NOAA) and US Coast Guard initiated the *California Marine Sanctuary Vessel Traffic Study* for Monterey and the three other national marine sanctuaries in California. The study evaluated the need for new vessel routing measures to protect these sanctuaries. The study recommended the following options for consideration:

- Continued voluntary compliance with the Western States Petroleum Association (WSPA) agreement;
- Action to seek an IMO designation of an Area To Be Avoided;
- Action to direct all vessels with oil or hazardous cargo to avoid sanctuary waters except when entering/leaving port;
- Limitations on movements of vessels carrying large quantities of bunker fuel;
- Limitations on tank barge movements; and
- Amending the San Francisco TSS to avoid the Monterey Bay NMS.

Pursuant to the *California Marine Sanctuary Vessel Traffic Study* report to Congress, in 1997 the US Coast Guard and the National Oceanic and Atmospheric Administration (NOAA) convened a workgroup of key stakeholders in industry, government, conservation organizations, and the public, in order to review vessel traffic issues relevant to the Monterey Bay National Marine Sanctuary (MBNMS). The Office of Spill Prevention and Response (OSPR), which is the Task Force's California member agency, participated on this workgroup. This workgroup's goal was to provide a vessel traffic management system that maximized protection of the Sanctuary resources while allowing for the continuation of safe, efficient and environmentally sound transportation. The recommendations of the MBNMS workgroup were developed through a process that evaluated environmental efficacy, socio-economic impacts, and institutional feasibility. These factors were considered as the group considered distances offshore at which vessels should transit in order to allow adequate time for rescue tugs to reach them in the event of a loss of propulsion or steering.

The final strategies which the workgroup recommended to the Navigation Safety Advisory Council (NAVSAC) of the US Coast Guard included the following elements:

1. Recommended distances from shore for Large Cargo Vessels (LCV) and vessels carrying hazardous materials;
2. Formal confirmation of current informal agreements with industry regarding routes for laden tankers (empty tankers will follow the LCV routes because of the bunkers they carry) and tank barges;
3. Adjustments to the San Francisco Bay Traffic Separation Scheme as recommended in the Port Access Routes Study;
4. Monitoring and reporting strategies;
5. Identification of a Rescue Vessel Network;
6. Near-Miss Reporting; and
7. Mariner education.

Their recommendations affecting international shipping were carried to the Navigation Subcommittee of the International Maritime Organization (IMO) by the US Coast Guard and NOAA, where they were approved in September of 1999. Full IMO approval was achieved in the spring of 2000. Navigation charts for the area will be revised to show recommended routes for large vessels 300 GT and larger in north-south tracks ranging from 13 to 20 nautical miles (nm) from shore between Big Sur and the San Mateo coastline. Ships carrying hazardous materials should follow north-south tracks between 25 and 30 nm from shore. Member companies of both the American Waterways Operators and the Western States Petroleum Association have indicated their intention to continue operations in accordance with voluntary agreements to operate safe distances from shore. [1]

Acknowledging the importance of US and Canadian Coast Guard involvement, the Task Force Members signed a Vessel Routing Resolution in 1996/1997 which authorized Task Force representatives to meet with the US Coast Guard Commander of the Pacific Area as well as the Western Regional Director of the Canadian Coast Guard to discuss offshore vessel routing issues and invite them to co-sponsor a vessel routing project workgroup. Task Force representatives subsequently spoke with Rick Bryant, Western Regional Director of the Canadian Coast Guard (CCG), in June of 1998 regarding the project concept, confirming his interest and support. As a result, representatives of the Canadian Coast Guard have participated on the Workgroup over the course of the project and have provided extensive data in support of the project.

Task Force representatives also met with US Coast Guard (USCG) Vice Admiral Collins, Pacific Area Commander, in December of 1998 and secured his commitment to participate and co-sponsor the project. Admiral Collins noted that such an effort would be consistent with the USCG's emphasis on waterway safety as outlined in the Maritime Transportation Safety initiative.[2] VADM Riutta, who replaced Admiral Collins in 2000, reiterated the USCG Pacific Area's support of the project. With their approval, CAPT Ed Page initiated the project, and CAPT Frank Whipple of the US Coast Guard Pacific Area Command co-chaired the WCOVTRM Project Workgroup from 1999 to 2001. CAPT Glenn Anderson co-chaired from 2001-2002, and significant project staff support has also been provided by the Pacific Area Command as well as Districts 17, 13, and 11.

The Office of Spill Prevention and Response (OSPR), the California member agency of the Task Force, volunteered to provide leadership for this project in 1995; Carl Moore was appointed as the Project Chairman until he left OSPR in 1998 to serve as interim director of the California Department of Boating and Waterways. At that time, Rick Holly of OSPR agreed to assume leadership of the project and served as the Task Force Co-Chair through project completion.

Once the Monterey Bay National Marine Sanctuary traffic management project was completed – as were the three USCG studies which preceded that effort - Rick Holly and the Task Force Executive Coordinator facilitated meetings of representatives of Task Force member agencies with representatives of NOAA, the USCG, and the CCG in February and March of 1999 to discuss the project. They reviewed the existing protection measures on the West Coast, and were briefed on the process and outcomes used in the Monterey Bay National Marine Sanctuary Vessel Management Project as a possible project model, i.e., evaluating how fast a

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[1] After consultation with the California Office of Oil Spill Prevention and Response (OSPR) and the US Coast Guard in 1992, ten major oil company members of the Western States Petroleum Association (WSPA) reached agreement on the routing of tankers carrying Alaskan North Slope (ANS) crude to California ports, committing their laden tankers to remain at least 50 miles seaward of the California coast while transiting the coastline. This routing has the effect of shifting crude oil tanker traffic away from the West Coast of North America shortly after leaving Prince William Sound, although tankers carrying refined petroleum products along the West Coast are not subject to the WSPA agreement. Tugs towing laden oil barges on the West Coast follow a similar voluntary agreement to stay 25 miles offshore, pursuant to their membership in the American Waterways Operators association.

[2] See An Assessment of the U.S. Marine Transportation System, A Report to Congress, September 1999

vessel might drift aground from various points offshore and comparing that with the time needed for response by a rescue tug.

They also discussed the possible geographic scope of the project, and agreed to recommend to the Project Workgroup that the project focus only on offshore traffic and not address issues specific to Traffic Separation Schemes (TSSs) or internal waters such as Puget Sound, San Francisco Bay, or the British Columbia/Alaska Inside Passage. OSPR recommended that San Diego be the southern-most point, while the Department of Environmental Conservation, Alaska's Task Force member agency, recommended that Cook Inlet be the northern-most point.

These project pre-planning participants agreed upon a list of stakeholders to be invited to participate on the West Coast Offshore Vessel Traffic Risk Management Project Workgroup. Subsequently, representatives from the following organizations were invited to serve as Project Workgroup members (in addition to representatives from the Task Force member agencies, the Canadian Coast Guard, the US Coast Guard, and NOAA):

- The Cook Inlet Regional Citizens' Advisory Council
- The British Columbia Chamber of Shipping
- The Canadian Council of Marine Carriers
- The Canadian Maritime Forces
- The Institute of Ocean Sciences in the Canadian Department of Fisheries and Oceans
- The Puget Sound Steamship Operators Association
- The Washington Public Ports Association
- Ocean Policy Advocates
- The Portland Marine Exchange
- The Port of Portland
- The California Coastal Commission
- The Western States Petroleum Association
- The Council of American Master Mariners
- The US Navy, Pacific Region
- The American Waterways Operators, Pacific Region
- INTERTANKO
- The Pacific Merchant Shipping Association
- Save Our Shores in California

For a final list of West Coast Offshore Vessel Traffic Workgroup members, please refer to Appendix A.[3] Many of these Workgroup members have given extensively of their time in researching and gathering data, as well as participating in meetings and conference calls. In particular, the Workgroup Co-Chairs, the Subcommittee Chairs, and several USCG Pacific Area staff (LCDR Brian Tetreault, LT Patricia Springer, CDR William Uberti, and CDR Stephen Danscuk) have contributed extensively of their valuable time and expertise for this project.

[3] A number of organizations either declined active workgroup membership and/or expressed interest in tracking the project so are therefore provided with electronic copies of meeting summary notes. These organizations include: the North Pacific Fishing Vessel Owners Association; the Baltic and International Maritime Council (BIMCO); the Chamber of Shipping of America; Transport Canada; US Coast Guard District 14; NOAA Headquarters; and the Waterways Management Directorate of the US Coast Guard.

The West Coast Offshore Vessel Traffic Risk Management Project (WCOVTRM) Workgroup held its first meeting in Seattle on April 27, 1999, hosted by the US Coast Guard 13th District. At this meeting, the Workgroup agreed to the following project goal statement: *To develop an offshore vessel traffic scheme for the West Coast that will prevent environmental damage*. By use of the term "scheme," the Workgroup was not limiting itself to only routing ecommendations. As the project evolved and all relevant issues and approaches were reviewed, a variety of recommendations to achieve this goal also evolved.

At their first meeting, the Workgroup agreed to the following objectives:

- That the geographic range of the project would be from Cook Inlet in the north to San Diego in the south. This area is 3 to 200 nautical miles offshore. Vessel traffic management issues for the Inside Passage of British Columbia and Alaska would not be within the purview of this project, although relevant issues could be addressed as part of the final Project Report, by way of recommendations for further action by appropriate authorities.
- That the recommendations should produce a level playing field and result in minimal disruption to the shipping industry;
- Pending a final subcommittee report and recommendation, that vessels to be addressed should include:
  1. Large Cargo Vessels of 300 gross tons or larger;
  2. Vessels carrying chemicals and hazardous material in bulk; and
  3. Tankers and tank barges.
- That a drift analysis would address both environmental factors and vessel characteristics; and
- Pending a final subcommittee report and recommendation, that “assist” or “rescue” vessels are those capable of assisting and stabilizing a drifting vessel, with a subcommittee charged to further refine that definition and bring it back to the full workgroup for adoption. Towing vessels meeting the final agreed-upon definition would then be inventoried.

The Workgroup further agreed to establish subcommittees to develop data and recommendations on the following topics (chairpersons noted in bold):

- DRIFT ANALYSIS: **CDR Jim Morris, NOAA Hazmat**
- ASSIST VESSELS: **Jerry McMahon, AWO**
- EVALUATION OF COASTAL TRAFFIC VOLUME: **Sven Eklof, US Navy**
- VESSEL TYPES: **Stan Norman, Washington Department of Ecology**
- IDENTIFY AND MAP EXISTING WEST COAST MEASURES: **USCG LCDR Brian Tetreault (replaced by LT Patricia Springer in 6/2000)**
- TRAFFIC LOCATIONS: This subcommittee was formed somewhat later in the project and was chaired by **Rick Holly, OSPR**

This meeting launched Phase I of the project, which focused on gathering data on the topics listed above. The reports of these subcommittees and other information gathered by Workgroup members compose Part III of this report, “Defining the Risk.” The subcommittees found that the necessary data were seldom available in exactly the format or content they needed, which indicates that improvements in vessel traffic data collection are needed within the marine transportation system. The problem is also indicative of the need for a regional analysis and overview of issues associated with offshore maritime operations.

Phase I lasted approximately from April of 1999 to December of 2000. The second phase of the project was initiated at the December 2000 meeting of the Project Workgroup as they began the process of data analysis, using a risk assessment model designed by USCG CDR William Uberti and LT Springer, and a Tug Response Time Analysis developed by Rick Holly. The Workgroup also reviewed various risk scenarios developed under USCG leadership for each state as well as the Province of British Columbia, and evaluated rescue tug response times. These risk analysis tools are described in Part IV, "Analysis of the Risk." The final phase of the Project, the development of findings and recommendations based upon the data and the risk analyses, is described in Part V of this Interim Report.

Part II. What's At Risk?

Risk equations multiply probability times consequences. As stated by US Coast Guard Vice Admiral Ray Riutta, Commander, Pacific Area, in his keynote address to the 2000 Annual Meeting of the States/British Columbia Oil Spill Task Force, "The probability of a major oil spill is small at any time, but the consequences are enormous if one occurs." A discussion of the probability analysis follows in Sections III and IV of this report. A brief discussion of the consequences – environmental, economic, and social – is provided in this section.

Environmental Consequences

Findings in Section 3, "Sensitive Marine Resources," of the US Coast Guard study *Evaluation of Oil Tanker Routing per Section 4111(b)(7) of OPA 90*, published in 1995 (please see description on page 7 above), state that :

1) The shoreline is not the only sensitive marine resource area threatened by potential future oil tanker spills; waters several miles offshore are also sensitive. [4]
2) The 10% most sensitive offshore marine resources are located within discrete areas along the Pacific coast, and <u>not all are enclosed within the boundaries of existing national marine sanctuaries</u> (emphasis added).
3) The 10% most sensitive offshore marine resources are located in areas often impossible to avoid while making port calls. (see #6 below)
4) The 20% (including the 10%) most sensitive offshore marine resources merge into a nearly continuous band along the entire Pacific coast (except the waters immediately offshore of Los Angeles/Long Beach) from Canada to Mexico.
5) The 30% (including the 20%) most sensitive offshore marine resources form a continuous band along the entire coast, including the approach waters of Los Angeles/Long Beach.
6) Vessels calling at the largest deep water ports from offshore routes must transit the most sensitive offshore marine resource areas (see #3 above).

It should also be noted that the study for the Volpe Center was done in 1993 before a number of salmon populations on the mainland coasts were listed under the US federal Endangered Species Act as either threatened and endangered species; thus, from a 2001 perspective, that study actually <u>understates</u> the risk. A similar study of sensitive offshore resources off the Alaska and British Columbia coasts was conducted by the same consultants who produced this report for the Volpe National Transportation Center. They determined that concentrations of seabirds, fisheries, and marine mammals can likewise be found along the entire Gulf of Alaska and British Columbia coastlines (see maps in Appendix B).

As explained in the Oil Tanker Routing report, "shoreline resources were not addressed in this study; however for the purposes of trajectory modeling, the entire shoreline of islands and mainland should be considered of high sensitivity to oil spills." While this statement was addressing only the Pacific Coast south from Canada to Mexico, it would be a safe extrapolation to extend that statement to cover the Pacific Coasts of both Alaska and British Columbia. There are no significant sections of shoreline of the West Coast which do not involve sensitive bird, plant, estuarine, or mammal habitat, or beaches and towns dependent upon tourism, or port entry areas economically sensitive to the need to keep maritime traffic moving.

The Executive Summary of the *Evaluation of Oil Tanker Routing* captures the key points regarding the nature and location of sensitive marine resources on the US West Coast as follows:

[4] (Editor's Note: This reference to tanker spills must be taken in context of the study's focus and should not be interpreted to indicate that only tank vessels represent oil spill risks.)

- "[The study] analyzed both the oil sensitivity of various marine species and their habitats, as well as the population densities and life cycle activities of each species. Results showed that significant areas of offshore waters, as well as the entire shoreline, are sensitive to oil."
- "Offshore areas with the most oil-sensitive resources...lie both inside and outside the boundaries of existing national marine sanctuaries..."
- "By including...[the top] 30% of all [sensitive area] indices, a contiguous zone is formed along the entire Pacific coast which extends out to 25 nautical miles, and to 50 nautical miles in the vicinity of the approaches to San Francisco Bay."
- "A restricted zone (entry denied to vessels with large quantities of oil as cargo or as bunker fuel) would afford a level of protection to the most sensitive marine resources. Such restricted zones would extend outward from the protected areas to provide a specified amount of time to intercept and remove most or all of a spill before it drifts into the protected area...it seems that boundaries should generally follow a response-time contour (e.g.,3 days) for the most sensitive areas selected for protection."

The entire shoreline, as well as a contiguous zone which extends at least out to 25 nautical miles, is sensitive to oil spills. Moreover, not all of the most sensitive areas are included in designated protection areas such as national marine sanctuaries.

The National Oceanic and Atmospheric Administration (NOAA)'s Office of Response and Restoration (OR&R) researchers, working with colleagues in state and federal governments, have produced Environmental Sensitivity Index (ESI) maps of US shorelines.[5] ESI maps include three kinds of information, delineated on maps by color-coding, symbols, or other markings:

- *Shoreline Rankings*: Shorelines are ranked according to their sensitivity, the natural persistence of oil, and the ease of cleanup.
- *Biological Resources:* The biological resources denoted on ESI maps include oil-sensitive animals and habitats that either (a) are used by oil-sensitive animals or (b) are themselves sensitive to spilled oil (coral reefs are an example of a sensitive habitat).
- *Human-Use Resources:* Human-use resources denoted on ESI maps are those important to humans and sensitive to oiling. They include, for example, heavily-used beaches, parks and marine sanctuaries, water intakes, and cultural and archaeological sites.

The Land Use Coordination Office (LUCO - Victoria) of the Provincial Government is responsible for the biophysical coastal inventory of British Columbia's 29,000 km (approximately 6,004 miles) of shoreline. This inventory is an ongoing multi-year project which collects and interprets coastal information, which is later used as baseline data for coastal planning and management in British Columbia.[6] The coastal resources inventory consists of :

- A biophysical inventory of coastlines using a combination of helicopter video and field sampling;
- The acquisition of biological and human use information, which includes fisheries, marine flora and fauna, and human use themes (i.e. ferry routes and anchorages); and

[5] NOAA's ESI maps can be accessed at the following website: http://response.restoration.noaa.gov
[6] For Information on British Columbia's Coastal Inventory program, check http://wlapwww.gov.bc.ca/eeeb/osris/osris.html For Information on British Columbia's Coastal Inventory program and BC Marine Oil Spill Information System, check http://wlapwww.gov.bc.ca/eeeb/osris/osris.html

- The creation of detailed 1:40,000 coastline maps.

Coastal resource information has been gathered and shore oil sensitivity mapping completed within the Vessel Traffic Risk area (either as Coastal Atlas or Geographic Information System (GIS) data) for the following sections of the British Columbia coastline:

- West Coast of Vancouver Island (Barkley Sound to Esperanza Inlet)
- North West Coast of Vancouver Island (Esperanza Inlet to Mexicana Point)
- Mid-Coast (Cape Caution to Princess Royal Island); and
- The Queen Charlotte Islands

Within the West Coast Vessel Traffic Risk Study area, the primary British Columbia shorelines of high environmental sensitivity to oiling due to potential for long-term oil retention are the protected bays, sounds and archipelagos along the outer coast. There are species along the entire coast which are designated as threatened or endangered by Canadian authorities. Two national parks include: the Pacific Rim National Park (Broken Islands/Long Beach, West Coast Trail [7]and the Gwaii Haana[8] and an International Biosphere[9], as well as numerous provincial parks (Brooks Peninsula, Cape Scott, Nuchatlitz.) Tourism (beach recreation, camping, kayaking, hiking) and eco-tourism (e.g., marine mammal watching) are major economic opportunities along the West Coast for coastal communities.

Economic Consequences

Once oil is spilled, mechanical recovery rates seldom exceed 20%. Although response and cleanup efforts are limited in their efficacy, the costs of such efforts can be quite high.[10] According to a study done by DF Dickins Associates for the North Puget Sound Long-Term Oil Spill Risk Management Panel in February, 2000, costs per gallon of US spills reviewed in the study ranged from a low of $119 to a high of $1,486. Since a responsible party is required by US law to pay natural resource damage costs and claims for economic losses associated with the spill, such costs are included in these figures in addition to actual response costs. The Province of British Columbia does not have Natural Resource Damage Assessment policies or processes, but the Canada Shipping Act covers third party damages and costs for reasonable measures of environmental reinstatement.

Dickens notes in the study summary that "The objective of this study was to compile information on selected US and worldwide spill incidents to serve as a guide to the expected range of costs which could result from future spills." He notes that spills were selected for analysis based on whether they were of persistent oils (crude, bunker, fuel oil), in coastal or estuarine locations, and had shoreline impacts. These criteria are also appropriate for our purposes. He further explains that "the focus was on incidents from 1989 to current. Cost figures are presented in 1997 US dollar equivalents to match the bulk of the original data as compiled in 1998. No effort was made to select case studies with any particular spill size or to concentrate on any particular vessel type." The vessel types reflected in the Dickens study include tankers, barges, and non-tank vessels, all of which are considered in this Project.

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[7] (http://parkscan.harbour.com/pacrim/)
[8] (South Moresby Queen Charlotte Islands http://parkscan.harbour.com/gwaii/)
[9] (Clayoquot Sound http://tofino.sd70.bc.ca/cbp/)
[10] Editor's Note: Use of dispersants is generally less costly, but not appropriate in all situations. The use of in-situ burning is also determined by a set of specific circumstances that make it inappropriate for all cleanup situations. No data is readily available regarding the costs of these alternative response techniques compared with mechanical recovery.

Dickens further states that “It should be noted that for many incidents the available cost information is either estimated or incomplete. While the total costs summarized here represent the most accurate data publicly available, the final figures shown may not necessarily represent the full cost to society or to a region. For the more recent spills, litigation may be ongoing with the final settlement costs yet to be determined.” In other words, the cost figures in this study may err on the low side. It is also noteworthy that the cost data from worldwide spill incidents varies considerably from the US data and should be used only for comparison rather than direct application to West Coast scenarios (Appendix C).

Social Consequences

The Prince William Sound Regional Citizens Advisory Council published a comprehensive guidebook in May of 1999 titled *Coping With Technological Disasters: A User Friendly Guidebook*. The Guidebook provides advice and aids for community groups, counselors, families, local governments, local businesses, and volunteers. As noted in the Preface (page vii), “Having experienced the Exxon Valdez disaster first-hand the citizens of RCAC wanted to fill a large gap in technological disaster planning – addressing the human impacts. In addition to drawing upon the personal experiences of RCAC’s members, RCAC consulted experts in the field of socioeconomic and technological disaster research to help in the development of this guidebook.” Research for the Guidebook was conducted by Dr. Steve Picou of the University of South Alabama, working with a research team that included academics from Pennsylvania State University, Yale University, the University of Wisconsin, Mississippi State, and the University of New Orleans.

Relevant excerpts from the foreword of the Guidebook follow:

> “Technological disasters can disrupt an ecosystem for many years and tend to disrupt the psychological well being of communities for long periods of time. Technological disasters…disrupt communities on multiple levels. The most obvious and tangible disruptions occur when the flow of goods, routine services, and jobs are adversely impacted. [These] can be restored in a fairly reasonable length of time. However there are other often ignored, poorly defined, poorly understood, intangible adverse impacts…..These include negative mental health impacts and chronic long-term psychological and physical impacts.
>
> “Long after the initial response has ended and the local government has returned to routine day-to-day operations, adverse psychological impacts associated with the disaster continue to erode the social fabric of the community. …These impacts include disruption of family structure and unity, family violence, depression, alcoholism, drug abuse, and psychological impairment. The extent of chronic mental health patterns appears to be correlated to the extent that a community is dependent on its natural resources for survival. As such, Native and non-Native fishing and subsistence-based communities are at higher risk for elevated levels of chronic psychological stress associated with technological disasters.”

In Chapter One of the Guidebook, it is noted that: “Natural disasters create what can be called a therapeutic community where activities are focused…As people pull together to place sandbags on dikes against floods, or help neighbors with homes destroyed in hurricanes, individuals, families, and communities bond for the good of the whole. Technological disasters, conversely, tend to produce a corrosive community characterized by unusually high levels of tension, conflict, ongoing litigation and chronic psychological stress….Fear of continued toxicity in the environment, of enduring threats to physical health, of long-term threats to traditional food sources and occupations, all lead to chronic problems difficult to understand, difficult to diagnose, and difficult to treat. "

This discussion of consequences admittedly focuses on the consequences of significant spill events, whether defined by spill volume or the sensitivity of an impacted area. Since the focus of this project is prevention of large vessel groundings and collisions, however, it is presumed that the spills we are working to avoid would be considered significant. As this section has explained, the impacts of such spills can be significant on many levels: both shoreline and offshore natural resources damages, response and cleanup costs, and human community impacts. The "enormous" consequences which VADM Riutta referred to spare neither humans nor natural resources, neither the innocent nor those responsible. In the case of oil spills, the old saying that "an ounce of prevention is worth a pound of cure" should be revised to "Prevention is the only cure."

Part III. Defining the Risk

This section of the Interim Project Report presents information and data collected by the Workgroup regarding vessels of concern, their estimated traffic patterns, the numbers of such vessels transiting along the West Coast, existing vessel traffic management measures, factors which affect vessel drift, historical data on West Coast casualties, assist vessel inventories and availability under severe weather conditions, and projections of future initiatives, both public and private, likely to affect this regional overview of vessel traffic.

Vessel Types

The West Coast Offshore Vessel Traffic Risk Management (WCOVTRM) Workgroup accepted the final report from the Vessel Types Subcommittee at their November 1999 meeting. The Vessel Type Subcommittee's final recommendations as to the types of vessels that should fall within the scope of the Workgroup's final report and recommendations were as follows:

1. Tank ships loaded with petroleum and/or hazardous material;
2. Tank barges loaded with petroleum and/or hazardous material;
3. Other Vessels, including:
    - Passenger and dry cargo vessels 300 gross tons and larger;
    - Fishing vessels 300 gross tons and larger in transit and not fishing;
    - Liquefied Natural Gas (LNG)/ Liquefied Petroleum Gas (LPG) tank ships;
    - Tank ships not loaded with petroleum or hazardous material (tank vessels can also carry tallow, molasses, and grain, for instance); and
    - Tank ships in ballast.

Typical West Coast Vessel Traffic Patterns

One of the objectives of the West Coast Off Shore Vessel Traffic Risk Management Project was to determine the routes most frequently used by these types of vessels as they transited the West Coast of the United States and Canada. The area of interest extends to 200 nautical miles seaward, and is bounded to the south by San Diego, California and to the North by the midpoint between Chugach Island and Barren Island (Cook Inlet).

<u>Tank and Non-tank Vessels</u>

No one source of comprehensive data on vessel traffic patterns was available, so data were reviewed from previous West Coast vessel traffic studies, and information was also obtained from the United States Coast Guard. Expert opinion data was gathered from pilots, vessel masters and trade associations. In addition, vessel track information was gathered from charts reviewed on vessels during routine inspections by OSPR staff in California. Based on these information sources, the Workgroup drew the following conclusions:

- In general, tank ships carrying crude oil which are operated by members of the Western States Petroleum Association (WSPA) are transiting at distances of 50 nautical miles or greater off the West Coast of the United States except when they are entering port or a traffic separation scheme around a port. [11]

[11] Operation "Crystal Ball" was a US Coast Guard's year-long survey to track the prevailing movement of tankers throughout the 11th Coast Guard District's area of responsibility (mainly California). During the 01 January to 31 December 1994 period, 177 verified tanker sightings were reported. Roughly 80 tankers were sighted within 50 nm of shore over that period. All vessels tracked remained within the operating areas agreed upon by WSPA and those tank ships identified within 50 nm were all determined to be either making a port call, transiting in ballast or carrying products other than oil from Valdez. The primary means of identification of the tankers in this study was by Coast Guard aircraft. The Coast Guard's purpose of the study was to show its ability to use spot-check surveillance from multiple patrol units, to

- Non-WSPA owned/operated crude oil tankers and refined product tankers (including those operated by WSPA companies) are not subject to this agreement and may transit the coast closer to shore.
- In general, US tank ships are complying with the Canadian voluntary Tanker Exclusion Zone (TEZ) off the West Coast of British Columbia. (Please reference the TEZ map in Appendix E)
- In general, tank barges carrying crude oil and refined petroleum products are traveling 25 nautical miles or further off the West Coast except when entering port or the traffic separation schemes around a port, according to an American Waterways Operators' informal agreement to do so.
- The tracks of dry cargo and bulk carriers vary significantly. They appear to vary from 3-30 nautical miles and further offshore when transiting the West Coast.
- A vessel master's decision to follow a specific track line is generally based upon prudence, weather, vessel traffic and geography. Weather avoidance is a major consideration for all vessels, and vessel tracks may be altered significantly to avoid heavy weather.

An example of one track from San Diego, California to the entrance to Cook Inlet, Alaska is given below. This track was considered the closest a prudent mariner would come to the coast. In general, vessels that are time constrained - particularly between the ports of Los Angeles/Long Beach and San Francisco/Oakland - will follow the coastal traffic separation schemes and their projected tracks. Vessels traveling from Los Angeles/Long Beach to ports further north will generally choose a more seaward track to avoid coastal recreational craft, Areas To Be Avoided, and Marine Sanctuaries.

West Coast Offshore Vessel Transit Estimate

GEOGRAPHIC POSITION	DEPARTURE POINTS/ GEOGRAPHIC POINTS		CLOSEST POINT OF APPROACH
San Diego	32-37'N	117-15'W	
LA/LB center of TSS	33-20'N	118-03.5'W	
Pt. Conception	34-20'N	120-31'W	6 miles
Pt. Arguello	34-30'N	120-45'W	6 miles
Pt. Sur	36-15.5'N	122 W	6 miles
Pigeon Point	37-08'N	122-30.5'W	6 miles
Due south of arrival buoy San Francisco TSS	37-45'N	122-4.5W	
North exit, SF TSS	37-56.3'N	123-04'W	
Pt. Arena	38-54'N	123-50'W	6 miles
Cape Mendocino	40-25'N	124-35'W	10 miles
Eureka arrival buoy	40-46.5'N	124-16.3'W	
Cape Blanco	42-50'N	124-46'W	6 miles
Columbia River arrival buoy	46-11.5'N	124-11.5'W	
Coos Bay arrival buoy	43-22'N	124-22.5'W	
Grays Harbor arrival buoy	46-55'N	124-15.5'W	
Cape Alava	48-10'N	124-57'W	9 miles
Cape Hinchinbrook	60-15'N	146-15'W	10 miles
Midpoint between Chugach Island and Barren Island	59-01'N	151-50'W	

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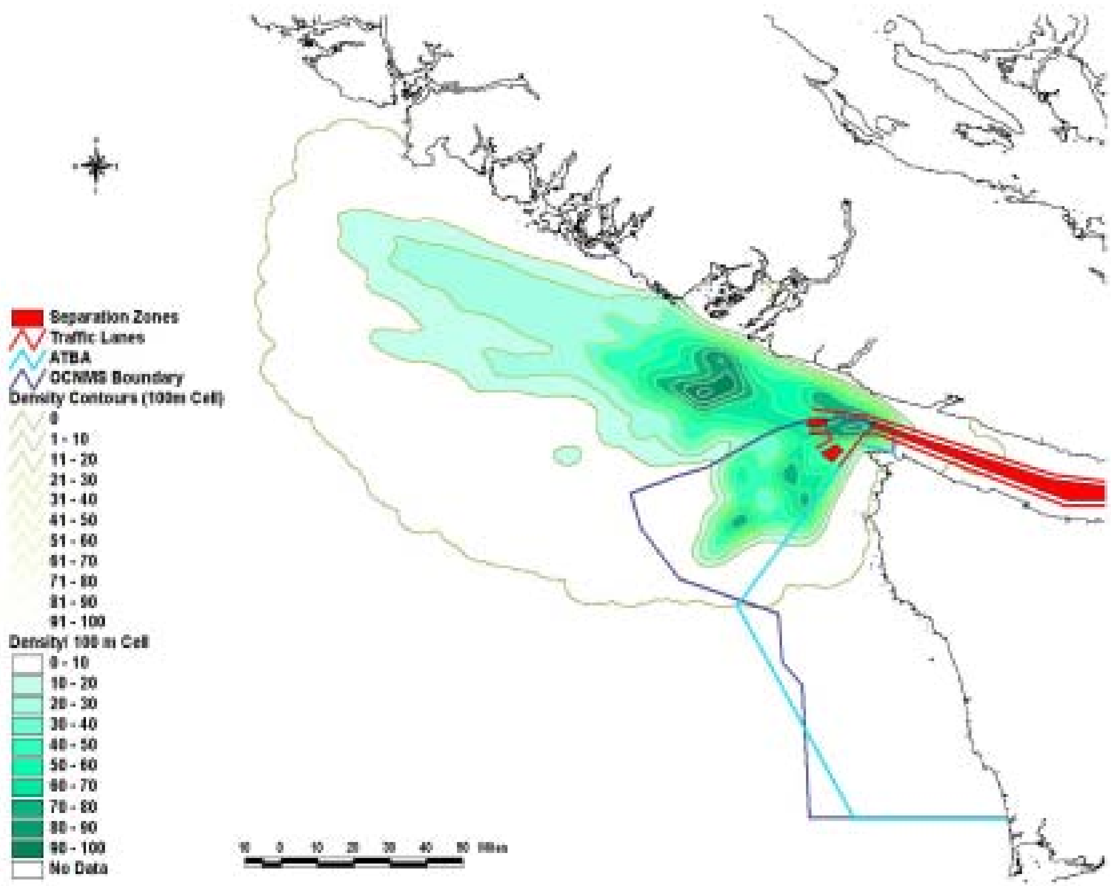
provide a series of snapshots of activity along the coast. This, in turn, allowed the analysis of predominant tank vessel routing along the coast. The study went further by showing accurate vessel identification and port call information for each vessel sighted, adding credibility to the operation's overall success and future enforcement possibilities.

Based on anecdotal information provided primarily by operators of cargo vessels, there appears to be a preferred northern track 25 miles off the West Coast and a preferred southern track 30 miles off. The offshore traffic entering the Straits of Juan de Fuca is generally on a track 20-35 miles offshore when they approach from the south. Vessels transiting north from the Straits usually have a closest point of approach (CPA) of 50 miles from the northern tip of Vancouver Island as they transit north. In a few cases, masters interviewed have opted to transit north and south outside of the United States Exclusive Economic Zone (EEZ).

Passenger Cruise Vessels

Cruise lines usually shift their fleet to the Alaska arena during the spring for the summer operating season, and return to the Caribbean in the fall while weather and visibility are good. Approximately 90% of the cruise ships transit from the Panama Canal to Seattle, WA or Vancouver, BC and commence their summer cruises through the Inside Passage from either Seattle or Vancouver, BC to Alaska. Except during this seasonal shift, cruise line traffic usually does not merge with the coastal traffic that runs between Cook Inlet and ports to the south, although some cruise ships from the Inside Passage may cross the Trans-Alaska Pipeline tanker traffic between Valdez and Seward in the Gulf of Alaska. In addition, some passenger ships do cruise in merging traffic areas off of San Diego and Los Angeles.

Yearly Fishing Vessel Traffic Density Estimates (1999)



Fishing Vessels

Seasonal fishing can increase the risk to vessel traffic in specific locations along the coast and at the entrances to some ports. Exact locations of fishing activities vary; weather and season affect when and where large fishing vessels will travel. Generally, there is an increase in fishing vessel traffic during the spring and summer months from Puget Sound to Cook Inlet. The graphic above, developed by the Olympic National Marine Sanctuary staff, charts the density of fishing vessel traffic near the entrance to the Strait of Juan de Fuca and the US and Canadian ports of Puget Sound.

Most vessels transiting between Asia and the West Coast of the United States travel a “Great Circle Route” that will usually merge with coastal traffic routes on a tangent from the north. There are several areas along the coast where ships on Great Circle Routes join coastal traffic; one such area is along Vancouver Island and another is off San Francisco Bay. Vessels on a Great Circle Route do not usually become a part of the north/south coastal traffic scheme, however, thereby posing a minimal transit risk except in the vicinity of the port they are entering.

Traditional Great Circle Routes[12]

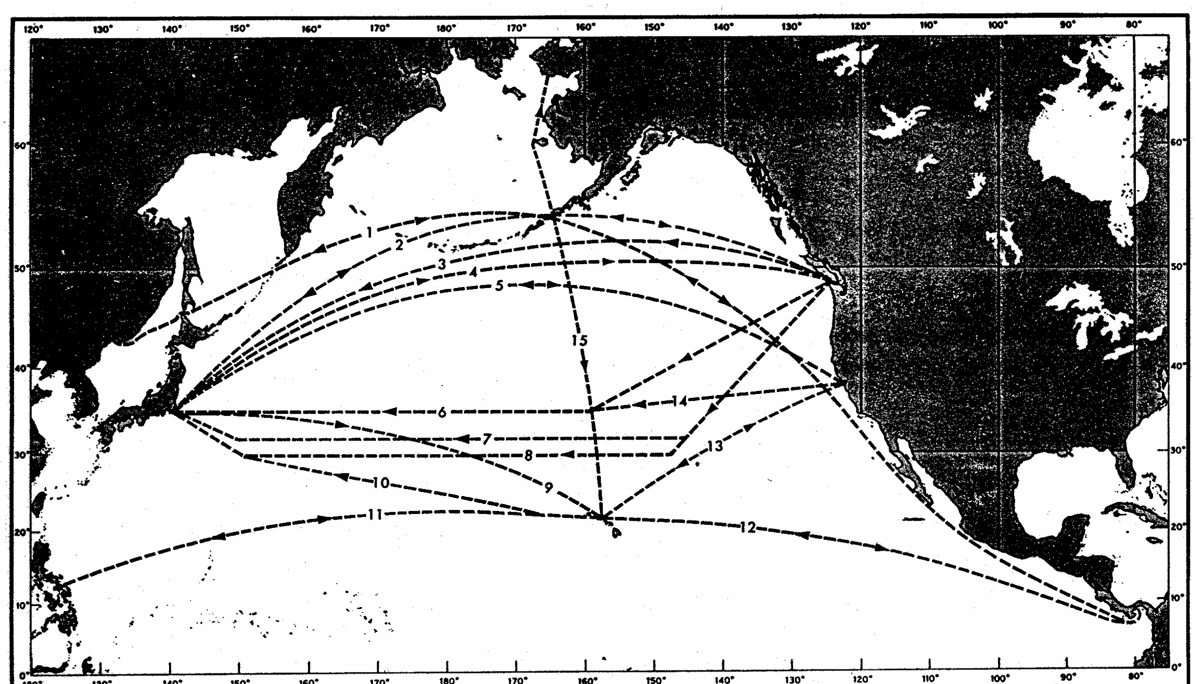


Figure 5

MAJOR SHIP ROUTES IN THE NORTH PACIFIC OCEAN

1.—Panama to Vladivostok and return
2.—Seattle to Yokohama and return
3.—Seattle to Yokohama
4.—Yokohama to Seattle
5.—San Francisco to Yokohama and return
6.—Seattle to Yokohama, Low-power Steamers (April, May, and October)
7.—Seattle to Yokohama, Low-power Steamers (November to March)
8.—Seattle to Yokohama, Low-power Steamers (Alternate Route, November to March)
9.—Yokohama to Honolulu
10.—Honolulu to Yokohama
11.—Honolulu to Manila and return
12.—Honolulu to Panama and return
13.—Honolulu to San Francisco and return
14.—San Francisco to Yokohama
15.—Honolulu to Nome and return

A master’s route decisions must also consider the locations and activities of military and commercial exercise areas along the coast between San Diego and Cook Inlet. Most of these exercise areas share boundaries with traffic lanes and marine sanctuaries and can extend from

[12] *Sailing Direction for Northern Pacific Ocean*, Pub 152, 3rd edition, 1989

the shore line to several hundred miles out to sea. Exercise area activities include fleet exercises, missile launches and testing, submarine transits, and air operations. A growing commercial space launch industry is operated out of Vandenberg Air Force Base on the California Coast. Vessels transiting through the military exercise areas usually receive daily activity information from radio broadcasts, or weekly and monthly "Notice to Mariners."

Another activity which is likely to influence the location of coastwise vessel traffic is ballast water exchange. US law establishes a voluntary program with a mandatory reporting requirement for vessels entering the US Exclusive Economic Zone (EEZ) to exchange ballast water mid-ocean in order to prevent the introduction of non-indigenous species. The Canadian federal government considers ballast water management a port issue, although the Canadian Coast Guard has an offshore advance report requirement to gain information regarding ballast water management followed by each vessel prior to the vessel's arrival at Canadian ports.

The Port of Vancouver, British Columbia has established a mandatory requirement that vessels arriving at that port have exchanged ballast water mid-ocean, with a safety exception. The State of California has passed legislation which requires vessels arriving at its ports from outside the US to conduct a ballast water exchange at least 200 miles offshore; this is having the effect of requiring vessels traveling coastwise from BC ports to California to travel 200 miles offshore or risk a citation. Whereas California law does not impact coastwise traffic from other US states, the State of Washington has passed legislation which does require vessels arriving from outside a region from the Columbia River to 50 degrees north, which is defined as common waters that include BC, to conduct a ballast water exchange at least 50 miles offshore. A bill passed the 2001Oregon Legislature that establishes two types of exchange: coastal and Open Ocean. The bill makes exchange mandatory for ships from outside the EEZ, as is the case in California and Washington. The coastal exchange is also mandatory and applies to ballast water taken on at a port on the west coast of North America if the port is south of 40 N latitude (Point Mendocino) or north of 50 N latitude (Vancouver Island). There is no required distance offshore for coastal exchange, since requiring ships to go offshore 200 miles to get west of the California current was considered impractical and also required ships to cross shipping lanes, which might increase the risk of collision.

Representatives from BC, Washington, Oregon, and California have discussed the inconsistencies in these emerging policies and have agreed to explore opportunities to make these policies more consistent coast wide. Until that is accomplished, however, traffic heading north from California to Washington waters may be traveling at least 50 miles offshore at some point in their transit, while traffic heading south to California from British Columbia may go at least 200 miles offshore at some point for ballast water exchange operations.

West Coast Vessel Traffic Volume

The Vessel Traffic Volume Subcommittee collected data on vessels transiting the Pacific North America coastline from San Diego, California to Cook Inlet, Alaska for a one year period from July 1, 1998 to June 30, 1999 in order to compile a “snapshot in time” that would give the Workgroup some idea of the volume of coastal traffic. To avoid duplication, it was important to focus only on arrivals in each port and to determine each vessel’s last port of call. In some cases this information was not available without extensive research. In other cases, the data had not been recorded. The final numbers include 964 arrivals for which no “Last Port of Call “(LPOC) data could be determined, representing 5% of the total.

This traffic volume data indicate that a total of 19,161 “arrivals” were documented for the period of 7/1/98 to 6/30/99; all vessel types as noted on page 17 of this report were included. Since some arrivals were the same ship making multiple port calls, the Workgroup extrapolated the total volume of traffic both between and arriving at ports for this representative period, which provides us with an indication of the magnitude of risk, although not the actual number of individual vessels visiting the West Coast over that period. A number of individual vessels would not have met our needs for this project.

The following ports or areas were included for transit information (data sources in italics):

- Prince William Sound, AK (Cook Inlet/Kodiak)*; Data Source: CSX Lines Inc/ Coast Guard VTS*
- Southeast Alaska; *Data Source: Southeast Alaska Pilot Logs*
- Western British Columbia, Canada; *Data Source: MCTS Tofino*
- Strait of Juan de Fuca; *Data Source: VTS Puget Sound and MCTS Tofino*
- Grays Harbor, WA; *Data Source: Coast Guard Notice of Arrival/Pilots Log*
- Columbia River; *Data Source: Coast Guard Advance Notice of Arrival Logs*
- Coos Bay, OR; *Data Source: Port of Coos Bay Arrival Logs*
- Eureka, CA; *Data Source: Westfall Stevedores Company*
- San Francisco Bay, CA; *Data Source: San Francisco Marine Exchange*
- Los Angeles/Long Beach, CA; *Data Source: Los Angeles/Long Beach Marine Exchange*
- San Diego, CA: *Data Source: Monthly Arrival Logs/Port of San Diego Records*

Please note that some of these “ports” are actually areas of multiple ports, such as the Strait of Juan de Fuca. There are a number of ports within that region serving Canada and Puget Sound, but this has no impact on the number of transits along the coast to and from that region.

The Workgroup noted 19,161 West Coast vessel transits during the period from July 1, 1998 to June 30, 1999. Approximately 20% of these transits were tank ships and barges. The majority of the remainder are large commercial vessels (LCVs) such as container ships and bulk product carriers; 89% were arrivals at the major ports of Prince William Sound, the Juan de Fuca region, the Columbia River, San Francisco Bay, and Los Angeles/Long Beach (LA/LB). Approximately 31% of the vessel arrivals were Trans-Pacific from Hawaii, Asia, Oceania, Europe through the Suez Canal, or the Middle East (see discussion of Great Circle Routes on page 22 above). After deducting the 5% unknown LPOC, that leaves 66%, or 12,646 vessel arrivals in West Coast ports over the one year study period that are known to be coastwise transits.

The Vessel Traffic Volume data are presented in various graphic formats in Appendix D. The first table provides a summary of all data; the following tables break out tank vessels, tank barges, and “other” vessels. Appendix D also includes bar graphs showing port arrivals by vessel type as well as pie charts showing port arrivals by Last Port of Call. A summary of vessel transits by section of the coast, based upon these volume data, is also provided in Appendix D.

Existing Vessel Management Measures

The West Coast Offshore Vessel Traffic Risk Management Project Workgroup recognizes that various Vessel Traffic Management measures are already in place along the West Coast of North America. The Workgroup reviewed these measures and their impacts on coastwise traffic patterns. Among existing measures are several informal industry "agreements" that establish voluntary precautionary measures. For example, certain commercial vessels transit outside the EEZ off the Alaskan coast, and laden tankers operated by WSPA companies, as well as laden tank barges operated by AWO member companies, observe voluntary agreements to operate 50 and 25 miles offshore, respectively (Please reference footnote #1). It should be noted that, as Alaskan oil supplies are reduced, the number of foreign flag tankers, which already outnumber US flag tankers covered under the WSPA agreement, are predicted to increase.

Another voluntary measure listed under *Reporting/Monitoring Systems* in Appendix E is the International Tug of Opportunity System (ITOS), which is jointly sponsored and financed by the US and Canadian shipping industry operating in Puget Sound, British Columbia's Inland Passage, the Strait of Juan de Fuca, Washington State's Pacific coast, and the mouth of the Columbia River. Position transmitters on participating tugs provide real-time location information, as well as details on the tug's ownership and specifications. This information, which is received and managed by the Puget Sound Marine Exchange, is shared with the US and Canadian Coast Guards, thus allowing them to assign a tug to a vessel rescue, if that tug is available and appropriate to the situation. ITOS does not provide information regarding the tug's readiness status.

A 1999 US Coast Guard study found that the ITOS system provided an incremental improvement to safety and environmental protection. In the Juan de Fuca waterway system the probability that an ITOS tug would be available ranged from 71% in eastern Puget Sound to 42% in the western straits, with a probability of coverage offshore ranging from 3% to 9%. These figures reflect availability projections based on the presence of a tug; such a tug may or may not be able to drop a tow and attempt a rescue. ITOS is essentially an information system, and one which provides even greater improvement in an area without VTS, such as the Columbia River. ITOS tugs operate from San Diego to Anchorage and the system is capable of monitoring and tracking tugs up to 100 miles off shore. This is especially important in areas outside of the coverage of radar, which describes most of the West Coast of the United States and Canada; however it is uncertain whether the Coast Guards beyond the Straits of Juan de Fuca and the Puget Sound area are utilizing ITOS to its full capability.

In general, regulatory management measures focus on major port approach areas and areas with established protection designations such as exclusion zones and marine sanctuaries. While the designation of these areas is regulatory in nature and may require International Maritime Organization (IMO) approval, compliance is usually voluntary. For example, the Olympic Coast Area To Be Avoided (ATBA) was effective in June of 1995. The ATBA extends from the Copalis River, 12 nautical miles North of Grays Harbor, to the entrance lanes of the Strait of Juan de Fuca at a point 25 nm off the coast. It does not exactly match the Olympic Coast National Marine Sanctuary designated area boundary. Tank vessels carrying petroleum products, crude oil or other hazardous materials are advised to stay out of the ATBA. The area is listed in advisory notices to mariners, but compliance is not mandatory. A similar ATBA has been designated for the Channel Islands National Marine Sanctuary in southern California.

A voluntary Tanker Exclusion Zone (TEZ) was also established along the West Coast of British Columbia to keep laden tankers west of the Zone in order to allow time for a rescue tug to reach a disabled and drifting tanker. The TEZ also reduces the probability of a tanker colliding with fishing vessels in the excluded area.

Canadian officials have recently been studying grounding probabilities associated with the Bowie Seamount, which lies just west of the TEZ border at its northern end, and rises to within approximately 60ft of the sea surface. Tanker companies contacted to date, however, have indicated in writing that their vessels typically stay at least tens of nautical miles from the Bowie Seamount for their most efficient route, and are well aware of the risks posed by Bowie. Although Canadian officials have not pursued modifications to the TEZ, the seamount is being extensively studied on an ecological basis, and a planning team is considering whether to recommend designation as a Marine Protected Area. [13]

Recognizing the collision risks associated with converging vessel traffic at port entrances, traffic lanes and traffic separation systems have been developed for most for major West Coast ports; in some instances, these TSSs have recently been revised. The US and Canadian Coast Guards cooperated on a Port Access Route Study for the Strait of Juan de Fuca and adjacent waters. Their final report issued in January, 2001 makes 28 recommendations for improving navigation safety in those waters. In addition, the US Coast Guard has proposed amendments to the Traffic Separation Scheme (TSS) for approaches to the Los Angeles/Long Beach harbor, and established a Regulated Navigation Area for San Pedro Bay. Both actions are based upon Port Access Route Studies for the area. The TSSs for San Francisco Bay and the Santa Barbara Channel have also been adjusted pursuant to the Monterey Bay National Marine Sanctuary study and recommendations. It is worth noting that many of the existing vessel management measures described above were created individually, only taking into account their local regions. Except for the area of the Monterey Bay National Marine Sanctuary vessel routing project, and possibly the Strait of Juan de Fuca area, no "big picture" view was taken of how the various measures worked together. The measures established at each port are designed specifically for that port, however these measures must also be easily understood and complied with by mariners traveling between ports.

Tables listing these measures either as Routing Measures, Reporting/Monitoring Systems, or Exclusion Zones and Protected Areas are available in Appendix E. These tables also provide information regarding the location, applicability, and the authority for these measures. Maps of these management measures are also included in Appendix E.

Ship Drift Analysis

In addition to evaluating the types and volume of vessels that transit the West Coast, their normal routes, and existing traffic management measures, the Project Workgroup was also interested in evaluating how fast a disabled vessel would drift ashore, as well as how fast an assist vessel might be available. A discussion of assist vessel availability can be found in the following section; this section focuses on the weather factors which contribute to ship drift rate.

NOAA's Hazardous Materials Response Division was requested by the States/British Columbia Oil Spill Task Force to analyze ship drift rates for the West Coast of North America from Alaska to southern California, in order to determine the risk of a disabled vessel coming ashore and grounding. For the purposes of this analysis a series of tables were generated of onshore drift speeds based upon 10 to 15 years of wind records from five different locations along the West Coast. These onshore drift speeds were computed using both mean and maximum onshore wind speeds during those time periods. To adequately consider all types of vessels, the tables compared the effects of varying windages (a ship's draft rate based upon vessel surfaces which function as "sail" areas) ranging from 2 percent to 10 percent. This analysis is based on a 1997 NOAA report on ship drift in the Strait of Juan De Fuca which determined that vessels of varying types, under various loading conditions, drifted within a range of 2% - 10% of wind-speed. (Appendix F).

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[13] An ecosystem overview report was produced in 1999 outlining physical, biological, cultural, and social characteristics of the Bowie Seamount Area. This report is published online at www.pac.dfo-mpo.gc.ca/oceans/Bowie/Splash.htm.

This analysis did not consider the use of computer model simulations. It was determined that modeling would not be viable without knowing all of the specific parameters that would control the drift of a ship. Results could vary greatly depending upon the location of the ship, the atmospheric and oceanographic conditions, the type, condition, and load of the ship, and how the ship was oriented to the wind, waves, and currents. It would not have been practicable to attempt to predict exactly where and when a drifting ship would come ashore for the entire West Coast and under every possible condition.

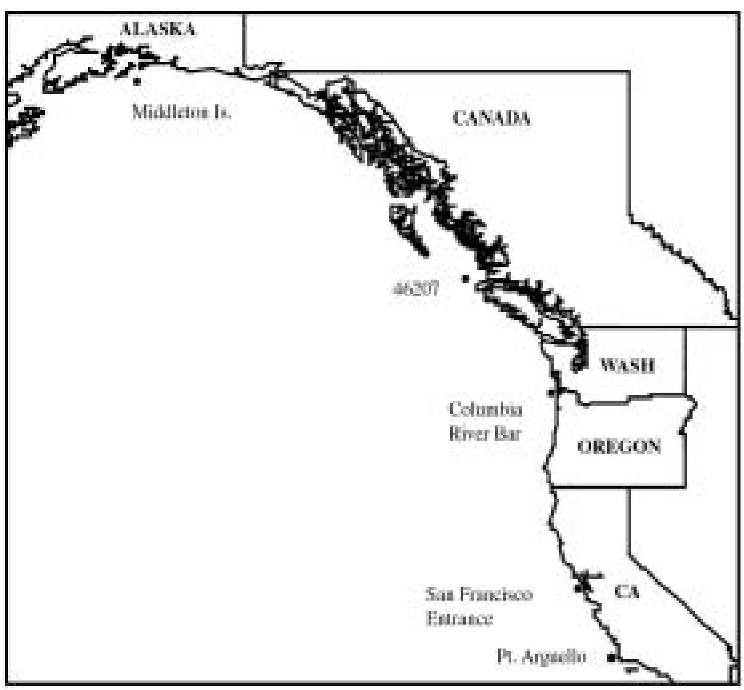
NOAA has eight weather buoys off the West Coast area of concern for this project. The Subcommittee chose to use hourly wind records from the following five wind stations which they considered representative of the predominant weather regimes on the West Coast:

Middleton Island (Alaska)	January 1985 - December 1995
Buoy 46207 north of Vancouver Island	February 1989 - February 1999
Buoy off Columbia River Bar	April 1984 - May 1998
Buoy off San Francisco Bay	August 1982 - December 1998
Buoy off Pt. Arguello	April 1982 - December 1998

The monthly mean wind statistics were computed from hourly data and are shown as statistical wind tables in Appendix F. These wind tables were used to compute the drift tables in the following way:

1. The onshore direction was determined to be perpendicular to the shore ± 22.5°;
2. The mean onshore winds were computed for the data set;
3. The maximum wind was defined as the strongest wind in the onshore direction that occurred at least 0.1% of the time.

The results are summarized below. Please note that the wind directions indicate the direction from which the winds are blowing.



Station locations for ship drift study

Station (Coastal Reference)	Onshore Direction	Mean Knots	Max Knots
Middleton Island (Alaska)	SSW- S-SSE	11	40
North of Vancouver Island (Canada)	SSW-W-WSW	13	33
Columbia River Mouth (Washington-Oregon)	WSW-W-WNW	10	40
Off San Francisco (Northern California)	SSW-SW-WSW	8	33
Off Pt. Arguello (Southern California)	SW-WSW-W	8	27

When its propulsion or steering fails, a ship will drift due to the combined effects of the wind, waves, current, trim and ballast. Tanker drift data have been studied with theory and models (Holder et al. 1981; Lewison et al. 1981; Smeaton 1981). These models can be quite complicated with a large scatter in predictions based upon variations in ship size, shape, orientation, list, degree of loading, and other parameters. Ship drift factors are also important in coast guard search and rescue operations (USCG 1991), where tables relating drift speed and angles for different vessels and environmental conditions are tabulated.

In addition to theoretical and test tank studies, industry records and questionnaires provide solid empirical information for defining bounds to the problem. For example, Holder et al. (1981) summarized an *Oil Companies International Marine Forum* study where questionnaires were sent to member companies as well as members of the International Chamber of Shipping. A total of 196 evaluation periods using 47 ships were used in the study. The direction and rate of ship drift could be determined from the questionnaire returns. Then, by subtracting for ocean current vectors, the drift due to wind and wave forces for intervals up to six hours was estimated. The ships were divided into categories by size and load type. Smaller vessels were considered less than 200,000 tons summer dead weight (SDWT). Larger vessels or very large carrying capacity are greater than 200,000 SDWT. The vessels were considered fully loaded or carrying ballast.

The final ship drift tables below were computed by assuming that the ship would drift at a percentage of the wind speed. For example, if the average onshore wind speed is 11 knots and the windage on the ship is 10 percent, then the wind would move the ship toward shore at 10 percent of 11 knots or 1.1 knots. The onshore ship drift tables for the five representative wind stations are presented as follows:

Middleton Island, Alaska (61° 9.5' N, 150° 6.8' W)

Windage[1] (knots)	Average Drift[2] (knots)	Worst Case Drift[3]
10%	1.1	4.0
8%	.8	3.2
6%	.7	2.4
4%	.4	1.6
2%	.2	0.8

North of Vancouver Island, Canada (50° 52.0' N, 129° 55.0' W)

Windage[1] (knots)	Average Drift[2] (knots)	Worst Case Drift[3]
10%	1.3	3.3
8%	1.0	2.6
6%	.9	2.0
4%	.5	1.3
2%	.3	0.7

Columbia River Mouth, Washington-Oregon (46° 7.0' N , 124° 30.0'W)

Windage[1] (knots)	Average Drift[2] (knots)	Worst Case Drift[3]
10%	.8	4.0
8%	.6	3.2
6%	.5	2.4
4%	.3	1.6
2%	.2	0.8

Off San Francisco, Northern California (37° 45.0' N, 122° 50.0' W)

Windage[1] (knots)	Average Drift[2] (knots)	Worst Case Drift[3]
10%	1.3	3.3
8%	1.0	2.6
6%	.9	2.0
4%	.5	1.3
2%	.3	0.7

Off Pt. Arguello, Southern California (34° 42.0' N , 120 58.0' W)

Windage[1] (knots)	Average Drift[2] (knots)	Worst Case Drift[3]
10%	1.3	2.7
8%	1.0	2.2
6%	.9	1.6
4%	.5	1.1
2%	.3	0.5

The columns in the table represent the percent of drift:
1 Percent of the wind used for computing the speed of drift
2 Speed of drift for the average onshore wind condition
3 Speed of drift for the maximum, or "worst case" onshore wind condition

Please see Appendix F for references, statistical wind data, and plots of the drift speed and wind speed for a loaded VLCC (Very Large Crude Carrier), a ballasted VLCC, a loaded small vessel, and a ballasted small vessel.

Other Factors Affecting Vessel Drift

Ocean currents may also affect drift, although not to the same extent as wind speed. Eastern North Pacific Ocean circulation patterns are summarized below.

Along the west coast of the U.S. and Canada, the large scale circulation starts with the Kuroshio Current off the Japan coast (analogous to the Gulf Stream in the Atlantic), which becomes the Kuroshio Extension and then the West Wind Drift which flows eastward along the subarctic boundary (between 40˚ N and 50˚ N latitude). As the West Wind Drift approaches the North American continent, it splits to form the southward flowing California Current, and the northward flowing Alaska Current. This split occurs off the west coast of Canada at approximately 45˚N in winter and 50˚N in summer. Four general zones are described for the coastal circulation in the eastern North Pacific:[14]

1. Southeastern Alaska
2. Pacific Northwest (PNW)
3. Central Coast (CC)
4. Southern California Bight (SCB)

1. Southeastern Alaska

The general circulation in the deep water off the North Pacific slope consists of large eddies and meanders up to 200 miles or more in diameter that have a net drift west to east at an average speed of 0.1 - 0.3 knots. Along the continental slope, the Alaska Current (also known as the Alaska Stream) is a persistent and dominant westward current along the continental slope between the Queen Charlotte Islands and the Aleutians. Off the Canadian and Southeast Alaskan continental slope, the current averages about 0.6 knots. The current narrows and strengthens to about 2 knots west of Kodiak Island.

On the continental shelf currents are forced by regional winds and runoff. During the spring, summer, and fall, the Alaska Coastal Current is the dominant feature. This fresh water current flows along the coast of the Gulf of Alaska in a counterclockwise direction. The current peaks during the fall when runoff is highest. Velocities along the southeast Alaskan shelf average between 0.2 - 0.4 knots. Off the Kenai Peninsula currents average 0.4 - 2 knots. During the winter months when runoff is at a minimum, the coastal current on the shelf is weak or nonexistent.

2. Western Continental United States (Washington, Oregon, California)

Circulation along the US West Coast is influenced by local to large scale winds and differences in sea level considered over a large horizontal scale (Baja to Monterey) (Hickey, 2000). Strub et al (1987) analyzed wind and current observations along the entire west coast and formulated three large scale wind and circulation patterns. These three circulation regimes are listed in the table below. Note that these areas are climatological descriptors, with transitions zones between them that may exhibit circulation patterns of either bordering zone. For example, the region between the Pacific Northwest (southern latitude 45˚N) and the California Central Coast (northern latitude 43˚N) may exhibit the circulation of either of the bordering circulation schemes.

Name	Latitude	Geographical
Pacific Northwest (PNW)	45N - 48N	North of Yaquina Head, OR to Strait of Juan de Fuca
Central Coast (CC)	39N - 43N	San Francisco Bay, CA to Cape Blanco, Oregon
Southern California Bight (SCB)	32N - 35N	US/Mexican border to San Luis Obispo Bay, CA

[14] These circulation descriptions are generalizations based on climatology. Large scale phenomena such as El Nino/La Nina, and the Pacific Decadal Oscillation are not included in this discussion. Local effects near shore may significantly alter the circulation and are also beyond the scope of this discussion.

Annual mean winds along the west coast are northward north of 40˚N and southward south of 40˚N. At 40˚N the seasonal variation in winds is greatest, decreasing farther away from that latitude. Just as warmer weather occurs in San Diego earlier than Seattle, the seasonal changes in circulation along the western continental U.S. begin in the southern areas and progress northward. The transition from winter to spring circulation patterns occurs about 2 months earlier in the SCB than in the PNW (Strub et al, 1987). Recent research suggests that this spring transition occurs at the end of the winter storm season (Chen and Wang, 2000).

a. Pacific Northwest

This coastal shelf area exhibits gradual seasonal changes with short term (<1 month) fluctuations; variations in the currents are larger in fall and winter than in summer. The southward flowing California Current extends from the shelf break to the coast (> 500 nm wide) in spring and summer. In fall and winter, the California Current moves offshore, and the northward flowing Davidson Current surfaces and extends from the coast to the mid-shelf. Typical velocities for the California Current are 0.2 - 0.4 knots, generally increasing offshore (Landry and Hickey, 1989). Typical velocities for the Davidson Current are 0.1 - 0.3 knots, stronger in the more southern portions of this zone.

b. Central Coast

This coastal shelf area is dominated by large, short period fluctuations. Seasonal changes in wind force are greatest in this region. The southward flowing California current extends to the coast in spring and summer (speeds generally less than < 0.5 knot; however, measurements up to 2 knots have been observed in the core (Lynn and Simpson 1987)), and the northward Davidson Current surfaces in fall and winter and extends from the coast to the mid-shelf (speeds less than 0.2 knots, 50 nm wide, Huyer *et al* 1991). These patterns are more consistent in the spring and summer; during fall and winter short-term fluctuations can be more pronounced.

c. Southern California Bight

The Southern California Bight is a dynamically variable region where colder, fresher subarctic waters from the north meet and mix with warmer, saltier water masses from the south. The California Current flows southward offshore of the shelf-break (0.2 - 0.3 knots), turns shoreward near offshore San Diego and then flows northward along the southern California coastline to become the California Countercurrent. The area where this turn occurs is sometimes called the Southern California Eddy (Hickey, 1992). During spring, the northward flowing California Countercurrent is less frequent. Northward current velocities usually peak (up to 1 knot) in summer and winter when the dominant winds relax or weaken.

The Santa Barbara Channel and adjoining Santa Maria Basin have three basic circulation regimes: Upwelling, Convergence and Relaxation, though these patterns can be distinctly determined only about 60% of the time. For this discussion, "southward" means following the coast with a southern or equator-ward component and "northward" means following the coast with a northward or pole-ward component. As the spring transition begins, the cyclonic (counterclockwise) circulation within the channel strengthens and the coastal southward circulation weakens to form the upwelling circulation pattern. During upwelling along the coast the southward current is generally stronger (0.5 knots) than the northward current (0.2 - 0.6 knots). As the northward current strengthens (0.5 - 0.8 knots) and the southward current slows a little (0.2 - 0.3 knots), the convergence pattern is established. Then when winds and the southward current weaken (0.1 - 0.3 knots) in the fall and winter, the relaxation circulation pattern becomes established, with a relatively stronger northward current (0.5 - 1 knots).

Historic Casualty Date Analysis

Casualty data collected for this report indicate that there were over 800 marine casualties involving vessels 300 gross tons or larger reported along the West Coast of North America between 1992 - 1999. Ninety-six of these casualties fell within the scope of this report as "offshore" (3-200 nm) casualties that had a potential for a significant oil spill.[15] These casualties ranged from mechanical failures to collisions or groundings -- basically, any incident that may have caused an oil spill of 1000 gallons or more. To identify any trends in these casualties, this analysis covers a longer time period (eight years) than the one-year period used for the Vessel Traffic Volume data. An appropriate average is used to determine the historical casualty rate of certain vessels types for the risk assessment tool described in Part IV of this report.

Offshore casualty data were drawn from the following sources:

- USCG Marine Safety Information System (MSIS) database for calendar years 1992-1999 (includes maritime casualty statistics for United States Coast Guard Districts: Alaska, Washington, Oregon, and California).
- Rescue Coordination Center (RCC) Victoria's SAR database for calendar years 1994 - 1999.

MSIS data were challenging to interpret, as locations of reported casualties are often estimated or reported incorrectly. There were also duplicate entries made by the different teams involved, i.e., the same incident may have caused several casualties (collision, fire, flooding, etc.) and one incident may involve several vessels, particularly in collisions. However, duplicate cases were eliminated during the research for this report, with the result that the total was reduced to 96 "true and separate" cases. RCC Victoria did not have data available prior to 1994, whereas the MSIS data dated back to 1992. This suggests the possibility that the casualty totals are lower than they might be otherwise.

The Pacific West Coast Vessel Casualty data (Appendix G) are presented as maps showing the ninety-six casualty locations. These maps are followed by tables and graphs which list and summarize the incidents. A heavy concentration of reported casualty positions near major ports can be discerned as one trend. This may be due to higher traffic density in these areas as well as to the fact that ships conduct their status review of steering and propulsion systems 12 hours prior to entering US waters, and thus the incidents are reported/monitored more closely (loss of steering was the most common type of equipment failure). For example, the US/Canadian Cooperative Vessel Traffic Services at the entrance to the Strait of Juan de Fuca requires an advance report on steering and propulsion tests. The USCG Marine Safety Office Puget Sound

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[15] Some of the criteria in considering which incidents had the potential of an oil spill were:
a. Loss of vessel control within 5nm of shoal water. Based on a moderate current of 1 to 2 kts, a vessel 5 nm from shore has significant potential of running aground within a couple of hours of the casualty; most casualties require two or more hours to affect repairs.
b. Any structural damage in the area of oil tanks was an indicator of a potential spill. Should the damage not have been identified, the oil discharge may have been significant.
c. The 800 vessel casualty entries were scrutinized to ensure that they were truly "offshore." If they occurred inside bays, straits, inlets, or near harbor entrances, the data were excluded, since this report focuses on transit-routing, not port entries, anchoring difficulties, or narrow channel issues.

has worked with the Puget Sound Steamship Operators Association to develop a recommended "Standard of Care" covering maintenance procedures, preventive measures, and actions in the event of a power loss[16].
Cracks/fractures in the tank vessel cargo tanks were the most common type of structural failure. Structural stress for the Trans-Alaska Pipeline System (TAPS) trade tankers is to be expected since they routinely transit through the harsh environments of Gulf of Alaska. Moreover, TAPS tankers are subject to very stringent inspection and reporting standards, which may skew the reported vessel casualties to include a high number of tanker incidents. Such incident frequency should decrease as new double-hull replacements come on line for the existing TAPS tankers.

The other clear trend which can be drawn from this data is that cargo/freight ships had the highest number of incidents, but this vessel type also represents the greatest number of offshore transits. The resultant overall rate of casualties per transits of 0.054% for cargo/freight ships represents a low average casualty risk. Overall, with the limited amount of information recorded in the available databases, the Workgroup is hesitant to state unilaterally that any trends can be discerned. Nevertheless, it is clear that incidents involving mechanical and equipment failures do occur off the West Coast with enough regularity - an average of 12 times/year - to justify our concern that such incidents could result in drift groundings and the release of oil and other hazardous materials into the environment (Appendix G).

It should be noted that only US and Canadian flag ships are required to report casualties outside of their own territorial waters. As a result, there may have actually been more loss-of-power or steering casualties which occurred within the US and Canadian EEZs affecting foreign flag vessels that were not reported. There is no worldwide vessel casualty database to reference, but one way to evaluate the casualty risk posed by vessels flying flags other than those of the US or Canada is to review information in the US Coast Guard's 2000 Port State Control report. The report notes that "the total number of vessels visiting US ports rose slightly from 1999 to 2000." Of the 51,871 port calls made by 7657 individual vessels from 95 different flag states, 11,767 exams were conducted and 193 vessels were detained.

The Port State Control Report concludes that the quality of vessels visiting US port sis improving, however, there are some exceptions. While the International Safety Management (ISM) Code implementation phases have contributed to the overall improvement in shipping, there were notable exceptions that indicated that some managing companies did not take the ISM Code seriously. Only 193 ships were detained in 2000, but the US Coast Guard believes that there are still too many substandard ships visiting our waters. Some of the deficiencies on these detained vessels included 43 cases of propulsion and auxiliary machinery problems, and 7 cases for navigation equipment problems. Table 6 of the Report, "Examinations and Detentions by Port," has been edited below to show only the West Coast ports:

[16] This "Standard of Care/COTP & PSSOA Vessel Power Loss Reduction Initiative" can be accessed at www.uscg.mil/d13/units/msopuget/msops.html.

Port	Coast Guard District	Examinations	Detentions
Anchorage, AK	17	158	3
Juneau, AK	17	48	0
Los Angeles, CA	11	929	27
Portland, OR	13	473	8
Puget Sound, WA	13	377	7
San Diego, CA	11	68	0
San Francisco, CA	11	533	5
Valdez, AK	17	2	1

There were 32 detentions in USCG District 11, 15 in District 13, and 4 in District 17, for a total of 51 on the West Coast in 2000.

Assist Vessel Availability

The Assist Vessel Subcommittee was charged with finalizing a definition of "assist vessel" and providing an inventory of such vessels on the West Coast. As approved by the project Workgroup at their 11/1/99 meeting, the definition of an "assist " or "rescue" vessel is "a tug or other vessel capable of assisting and stabilizing a drifting disabled vessel, in order to arrest the drift until such time as a suitable salvage/towing vessel can arrive on scene to provide necessary assistance." With this definition in mind, the Subcommittee developed an inventory of 182 ocean-going tugs operating out of "home-ports" on the West Coast. It should be noted that such an inventory is a "snapshot in time," since home-port assignments for tugs can change, but it does indicate the relative distribution of ocean-going tugs on the West Coast. Please reference Appendix H for this inventory.

Stan Norman of the Subcommittee then did a comparison of five studies which evaluated the bollard pull needed for open ocean work under worst-case storm event conditions (see ETV Capability Matrix, Appendix I). [17]Comparing that information with the information generated by NOAA on worst case wind data for the West Coast, the Assist Vessel Subcommittee developed a "severe weather" rescue tug inventory (see below) as a subset of the West Coast Tug Inventory. The bollard pull specifications are noted in the footnote. The inventory provides information on home-port location, tug name, operator, and bollard pull.

Since these are all working tugs, the Subcommittee agreed that only ports with a sufficient population of resident, high-power, ocean-going tugs should be included in the Severe Weather inventory if we are to assume that a rescue tug will be available to respond to a worst case situation most of the time. The Canadian Coast Guard maintains three vessels along the Pacific Coast, and the US Coast Guard maintains vessels off Alaska and the Pacific Northwest during fishing season. However, it should be understood that both Navy and US and Canadian Coast Guard vessel assets are not included, since the movements of such craft may be considered confidential and not considered as available.

There are only two designated salvage vessels for the entire the West Coast. The *Salvage Chief*, operated by Fred Devine Diving and Salvage, is home-ported at Astoria, Oregon. The American Salvor, operated by Crowley Marine Services, is home-ported in Long Beach, California. In addition, Crowley Marine Services maintains "fly-away" salvage equipment packs in San Francisco, Seattle, Anchorage, and Captain's Bay, Alaska. The US Navy also maintains salvage equipment and vessels which are available to a Federal On-Scene Coordinator in the event of an oil spill or the threat of a spill.

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[17] Bollard pull is a measure of a tug's pulling power measured in tons. For example, a tug with a bollard pull of 70 tons is able to exert a force of approximately 140,000 pounds on a vessel being towed.

As new tugs are brought on-line, they are likely to use a Z-drive configuration, which makes them more maneuverable for vessel assists. No other major changes in "tug technology" or availability are anticipated at this time.

The Assist Vessel Subcommittee compiled a one-page summary of the equipment which a rescue vessel would require to provide a hook-up and tow, as well as a summary of the procedures which would most likely be implemented (Appendix I).

Severe Weather Rescue Tug Inventory[18]

Location	***Tug Name***	***Bollard Pull (Actual or Est.)***[19]	***Operator***
Prince William Sound	Alert	150	Crowley
Prince William Sound	Attentive	150	Crowley
Prince William Sound	Aware	150	Crowley
Prince William Sound	Nanuq	106	Crowley
Prince William Sound	Sea Venture	120	Crowley
Prince William Sound	Sea Voyage	120	Crowley
Prince William Sound	Tan'erliq	106	Crowley
Vancouver BC	Rivtow Captain Bob	101	Rivtow
Vancouver BC	Commodore	90	Seaspan
Vancouver BC	Regent	90	Seaspan
Vancouver BC	Discovery	66	Seaspan
Puget Sound	Adventurer	75	Crowley
Puget Sound	Bulwark	75	Crowley
Puget Sound	Cavalier	75	Crowley
Puget Sound	Chief	60	Crowley
Puget Sound	Commander	75	Crowley
Puget Sound	Guardsman	75	Crowley
Puget Sound	Guide	60	Crowley
Puget Sound	Hunter	75	Crowley
Puget Sound	Invader	75	Crowley
Puget Sound	Protector	60	Crowley
Puget Sound	Ranger	75	Crowley
Puget Sound	Sea Valiant	88	Crowley
Puget Sound	Sea Valor	88	Crowley
Puget Sound	Sea Victory	120	Crowley
Puget Sound	Stalwart	75	Crowley
Puget Sound	Warrior	75	Crowley
Puget Sound	Barbara Foss	72	Foss
Puget Sound	Fairwind	60	Foss
Puget Sound	Garth Foss	87	Foss

[18] General criteria for selection: Cook Inlet to Prince Rupert = 100 tons bollard pull or greater, Prince Rupert to San Francisco = 60 tons bollard pull or greater, San Francisco to San Diego = 40 tons bollard pull or greater. Selected tugs that do not quite meet the bollard pull criteria have been included in Vancouver, the Columbia River, San Francisco and San Diego based on the professional judgement of Subcommittee members.

[19] Bollard pull estimates are based on horsepower comparison with tugs of similar horsepower and propulsion system that have verified actual bollard pull. Bollard pull is in direct ahead mode.

Location	***Tug Name***	***Bollard Pull (Actual or Est.)***	***Operator***
Puget Sound	Jeffrey Foss	72	Foss
Puget Sound	Lindsey Foss	87	Foss
Puget Sound	Pacific Falcon	60	Harley
Puget Sound	Ocean Warrior	60	Sea Coast
Puget Sound	Alaskan Victory 60		Victory
Puget Sound	Commander	60	Victory
Puget Sound	Enforcer	60	Victory
Puget Sound	Alaska Mariner	60	Western
Puget Sound	Ocean Ranger	60	Western
Puget Sound	Pacific Titan	60	Western
Puget Sound	Western Titan	60	Western
Columbia River	Daniel Foss	44	Foss
Columbia River	Howard Olsen	41	Foss
Coos Bay	Natoma	60	Sause Bros.
Coos Bay	Navajo	60	Sause Bros.
Coos Bay	Salishan	60	Sause Bros.
Coos Bay	Titan	60	Sause Bros.
Humboldt Bay	Koos King	57	Knutzen
Humboldt Bay	Koos Humbolt	33	Knutzen
San Francisco	Delta Carey	64	Bay Delta
San Francisco	Delta Deanna	71	Bay Delta
San Francisco	Delta Linda	71	Bay Delta
San Francisco	Andrew Foss	50	Foss
San Francisco	Brynn Foss	39	Foss
San Francisco	Richard Foss	38	Foss
San Francisco	Silver Eagle	62	Oscar Niemeth
San Francisco	S/R California	75	SeaRiver
San Francisco	S/R Carquinez	66	SeaRiver
San Francisco	S/R Mare Island64		SeaRiver
LA/LB	Admiral	54	Crowley
LA/LB	Leader	54	Crowley
LA/LB	Master	54	Crowley
LA/LB	Scout	54	Crowley
LA/LB	Sea Cloud	55	Crowley
LA/LB	Sea Robin	55	Crowley
LA/LB	Eddie C	46	Foss
LA/LB	Peter Foss	44	Foss
LA/LB	Phillips Foss	63	Foss
LA/LB	Escort Eagle	60	Millenium
LA/LB	Millenium Falcon	70	Millenium
LA/LB	Millenium Maverick	70	Millenium
LA/LB	Millenium Star	70	Millenium
San Diego	Saturn	28	Crowley
San Diego	Spartan	28	Crowley
San Diego	Navajo	100	US Navy
San Diego	Sioux	100	US Navy
San Diego	USN-6	60	US Navy

A Severe-Weather Tug Assist Case Study:

On February 11th at 1120 hours, the engines failed on the Greek-registered, container vessel M/V Hanjin Elizabeth (approx. 37,000 DWT). The vessel began drifting about 80 nautical miles from Brooks Peninsula on Vancouver Island towards Cape Scott/Scott Islands located at the most northerly end of the island. A crew of 24 were on board.

On February 12th at around 0200 hours, the Liberian-registered, general cargo vessel M/V Caria (approx. 26,000 DWT) also experienced engine failure and began drifting 17 nautical miles from Brooks Peninsula towards the northern end of Vancouver Island. There were 20 crew members on board.

Severe storm to hurricane force winds and seas prevail in the area. The weather conditions - storm to hurricane force winds and 10 meter seas - were unusual, but not unheard of for February. At the onset of both vessel casualties, it was anticipated that they would run aground before the tugs arrived and secured a tow. The major potential polluting substance was the vessels' bunker fuel of diesel and intermediate types. The maximum fuel capacity of the M/V Hanjin Elizabeth is approximately 4,000 tons (27,900 barrels). It was reported to have over 1,915 tons of bunker fuel - mostly a thick, intermediate type oil. The M/V Caria bunker fuel capacity is about 1,700 tons (12,000 barrels). The amount of fuel on board was reported to be approximately 913 tons. The container vessel was known to have some dangerous goods on board, whereas the bulk-cargo vessel was transporting pulp product. The Cape Scott/Scott Island group is a highly significant ecological area with vulnerable populations of seabirds and seals. Cape Scott Provincial Park is at the north end of the island. This park is noted for its wilderness hiking and historical setting.

Ocean-going rescue tugs from the United States and Canada were dispatched by the Canadian Coast Guard's Rescue Co-ordination Center in Victoria and Vessel Traffic Services. CCG also dispatched two of its own vessels. The M/V Hanjin Elizabeth drifted "not under command" for about 100 nautical miles to the north over a 33 hour time period before regaining engine functions. The M/V Hanjin Elizabeth had drifted past and just west of the Triangle and Scott chain of islands before the first tug arrived. These islands extend 28 nautical miles from Cape Scott. The initial rescue tug on-scene - the U.S. "Hunter" - failed to sustain towing. It took only about an hour to fix a towline, but within an hour the towline broke due to storm force winds and seas. Fortunately, when the M/V Hanjin Elizabeth was in tow, it was stabilized long enough to enable a crew to safely repair its engine. Within a couple of hours the vessel was operating under its own power. The US "Hunter" took approximately 20 hours to arrive from its home port of Anacortes. It traveled over 360 nautical miles via the "Inside Passage" between Vancouver Island and the mainland and around Cape Scott in order to avoid storm conditions. The second and larger US tug, the "Sea Victory" from Seattle took 29 hours to arrive on scene. It also took the same Inside Passage route - traveling about 400 nautical miles. The third tug on-scene was the Canadian "Seaspan" from Port Hardy. It took 7 hours to arrive (90 nautical miles). The M/V Hanjin Elizabeth engines regained functions by the time the U.S. "Sea Victory" arrived. The CCG vessel - the "John P. Tully" - could only be on standby for potential crew rescue. The M/V Hanjin Elizabeth reached its intended destination of Seattle under its own power, but escorted by the two tugs. There was no loss of life, cargo, or oil.

The M/V Caria began drifting from a position much closer to Vancouver Island than the M/V Hanjin Elizabeth. The M/V Caria drifted 41 nautical miles over a 19 hour period. It came within 10 nautical miles of both Vancouver Island and Scott Islands before a towline was secured by the Canadian tug "Arctic Hooper". It took the Arctic Hooper eight hours to arrive from Tahsis, on the west side of Vancouver Island, approximately 80 nautical miles away. At the time of the tug's arrival, the M/V Caria was rigging its anchor to drop and drag to help avoid grounding. The CCG vessel "Narwhal" was on standby for potential crew rescue. There were difficulties in securing a towline due to severe sea conditions - a very dangerous task for vessel and tug crews. It took over 5 hours to secure a line. Based on drift rate, there was about 2 hours to spare before the M/V Caria could have grounded. The vessel was successfully towed through Scott Channel to a safe refuge in Hardy Bay (Port Hardy - Johnstone Strait) for repairs. There was no loss of life, cargo, or oil.

The total number of tugs dispatched was six, of which only one managed to secure a towline. The rescue tugs were- US "Sea Victory", US "Commander", the US "Barbara Foss", Canadian "Arctic Hooper" and Canadian "Seaspan Queen". The two CCG vessels - the "Narwhal" and "John P. Tully" could only stand by for crew rescue and response monitoring functions. Incident closure was February 13th at 0800 hours when the M/V Hanjin Elizabeth was under command *en route* to Seattle, and the M/V Caria reached Hardy Bay and moored.[20]

Future Projections

The information in this section describes anticipated traffic monitoring and waterways safety management initiatives. These initiatives are being driven by certain events and issues as outlined in Part A. Part B describes national and international initiatives underway to address these issues. Part C examines oil spill and casualty trends that suggest that these initiatives are achieving their objectives.

A. DRIVERS

Traffic Projections:

Maritime traffic is predicted to experience a world-wide boom in the next 20 years. Today's world merchant fleet of over 720 million deadweight tons is expected to grow to over 884 million deadweight tons by 2005. For the United States, ships move 95% of all foreign trade, and 25% of domestic trade. Each year 350 billion tons of cargo and 3.5 billion barrels of oil are shipped via water. This equates to roughly one trillion dollars of freight. Volume is expected to double in 7 to 10 years and triple by the year 2020.

On March 29, 2001, the US Maritime Administration (MARAD) and the US Army Corps of Engineers (Corps) released its December 2000 official *US Foreign Waterborne Transportation Statistics.*[21] Year-to-date figures through December 2000 show an increase in cargo volume of 7% for imports and 3% for exports over the same time period for 1999. The 7% increase equates to 52,985,000 metric tons of cargo.

On the West Coast, we have experienced a growth in tonnage from 60 million tons in 1970 to over 240 million tons in 2000, valued at over 260 billion dollars. This industry generates over 91,000 jobs and over five billion dollars in wages to the economy. West Coast trade represents 7% of our gross domestic product and is the key link to trade with Asian ports. The continued growth in cargo and trade, the increase in the number of merchant and passenger vessels, the construction of larger and faster ships (e.g. "Mega Ships"), and more seamless intermodal links

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[20] For more information on these incidents, please visit the following website: http://wlapwww.gov.bc.ca/eeeb/ENVSITRP2/SITHOME/SITHOME.HTM

[21] US Foreign Waterborne Transportation Statistics www.marad.dot.gov/Headlines/announcements/2001/apr2.htm

and systems place greater performance demands on carriers and shippers. Contrast this with a growing concern with the ability of the current maritime infrastructure to meet these changing demands, plus an increasingly sensitive and informed public regarding safety and environmental issues, and we have the potential for serious contention among different stakeholders.

Regarding the movement of bulk oil cargoes on the West Coast, it is anticipated that more crude oil will be imported as the output from Alaskan fields dwindles. On the other hand, exploration and development activities are likely to be permitted in the Strategic Petroleum Reserve area west of Prudhoe Bay, Alaska, so there may be little reduction in the long run if new sources come on-line.

In addition, there are two proposals in British Columbia worth noting, although they are both far from certain at this time. One is the possibility of offshore oil and gas development and the other is a proposal for the construction of a 500 million barrel terminal in the Prince Rupert area. The terminal is projected to require once-weekly delivery of oil products by an Ultra-Large Crude Carrier tanker; deliveries from the terminal to coastal communities would then be done by smaller tankers.

Port Security and Crime

As commerce becomes more dependent upon maritime trade, vessels will become both tools and targets for crime. This elevated risk is expected to be the catalyst for increased vigilance regarding the safety of our coastal areas, and in turn, drive the funding for offshore vessel traffic monitoring.

On April 27, 1999, President Clinton signed an Executive Memorandum directing the establishment of the Interagency Commission on Crime and Security in US Seaports. Citing both the importance of seaports to the nation's commerce as well as the presence of crime and conspiracies that "pose a threat to the people and critical infrastructures of seaport cities," the President called for "a comprehensive review of the nature and extent of seaport crime and the overall state of security in seaports, as well as the ways in which governments at all levels are responding to the problem." An Interagency Commission on Crime and Security in US Seaports was created. The Commission produced a report in the spring of 2000,[22] which included the following recommendations:

- Strengthen interagency, intergovernmental, and public/private sector efforts to address the threats of seaport crime (including terrorism), and to enhance control of imports and exports through seaports;
- Strengthen the efforts of the Marine Transportation System (MTS) national organizations to enhance the awareness of state and local governments and private sector interests of the vital role that seaports play in national security that extends beyond their indispensable contribution to the nation's economy;
- Work internationally to strengthen global seaport security by increasing cooperation and information sharing with foreign law enforcement and customs agencies.

While these initiatives may appear to focus on port security, vessel security and vessel mobility within ports will receive the primary attention. Obviously if and when a vessel is targeted for crime, it is not just that one vessel that is affected. Negative impacts on the environment and

[22] The May 2000 Report of the Interagency Commission on Crime and Security in US Seaports can be found at: www.uscg.mil/overview/icssrpt.pdf

the economy will filter through not just the port(s) but the transit zone(s), ecosystems, labor market, and numerous subsequent consequences.

Ensuring robust port and maritime security is a national priority and an intermodal challenge, with impacts in America's heartland communities just as directly as the US seaport cities where cargo and passenger vessels arrive and depart daily. The United States has more than 1,000 harbor channels, 25,000 miles of inland, intracoastal and coastal waterways, serving 361 ports containing more than 3,700 passenger and cargo terminals. Approximately 95 percent of our Nation's international trade moves by water.

While effective homeland security is built upon the principles of awareness, prevention, response, and consequence management, the primary objectives are awareness and prevention, since we hope to avoid any need for future consequence management. Prevention places a premium on awareness, detecting, identifying, and tracking threats to our homeland security. While there are no guarantees, there is good reason to believe that we can improve our national ability to detect potential threats through effective use of information that is, to a great extent, already available. Exploiting available information to separate the good from the bad, and then stop the bad, is the heart of an overall Maritime Homeland Security Strategy. This strategy must facilitate legitimate maritime commerce, which is supposed to double in the next 20 years, while filtering threats by using real time intelligence.

The task of ensuring America's maritime homeland security is enormous. Using all the resources and tools at their disposal, the Coast Guard's five Maritime Homeland Security Goals are to:

- Build Maritime Domain Awareness;
- Control the movement of high-interest vessels;
- Enhance Coast Guard presence in and around ports for both deterrence and response;
- Protect critical infrastructure; and,
- Ensure maximum domestic and international outreach.

There are some key principles which should underlie national efforts to build a new baseline of operations for maritime security:

- The approach must be comprehensive, reaching both security at port facilities and in the marine environment. It must reach the security of physical assets and the security of maritime and port personnel and passengers.
- Due to the widely diverse nature of the maritime system across the country, and the widely divergent nature of operations among ports, local planning and coordination with local and state authorities will be crucial.
- Like any transportation network, the maritime transportation system is in a constant state of growth and change. The system created must therefore be one that is capable of evolving over time, and where the expectation of that evolution is clearly established.
- And, finally, the system must fully recognize the intermodal nature of marine transportation. Cargo that is unloaded from a ship today in a seaport will move quickly to other modes of transportation. There is no better example than the cargo container - a phenomenon that has been successful precisely because it is fundamentally intermodal - a cargo container arriving at a U.S. seaport today can be virtually anywhere in the heartland of America via truck and/or rail tomorrow. Accordingly, maritime security measures must be fully integrated with security measures being implemented in other modes of transportation. It has been

estimated that more than 6 million containers enter the country via U.S. ports each year, representing more than 11 million twenty-foot container equivalent units (TEUs) of cargo.

Sustained prosperity clearly depends upon accommodating the global trade that is predicted to double or triple in the next 20 years, so government needs to be attentive to finding ways to minimize the disruptions and delays caused by federal inspections and other requirements. Focusing on port and vessel security improvements, terrorism, and crime prevention while also balancing the impact of security measures on projected increases in trade will be significant challenges in the next few years.

B. INITIATIVES TOWARD SOLUTIONS

The Marine Transportation System (MTS)

To meet the escalating risks of a major marine casualty and pollution incident, while maintaining economic competitiveness and national security, managers of the marine transportation system must facilitate coordination and partnership among all users and stakeholders. There must be a clear understanding of the projected demands, and regulatory requirements must be harmonized at the federal, state and local levels to help guide and inform the public and private decision-makers.

In September of 1999 a comprehensive US Department of Transportation report to Congress reviewed and assessed the issues and challenges facing the MTS. Coordinating bodies were created, representing both public and private interests, to provide oversight for implementation of the report's recommendations.[23]

MTS' goals and plans are being implemented for a wide spectrum of issues ranging from establishing a vessel clearance information exchange and "one-stop shopping" for inspection and reporting requirements, to improving security awareness to safety of vessel operation and minimizing human error. Specifically, MTS' safety improvement goals are:

- Widespread use of safety management systems in design and operations;
- Accurate, reliable and real-time information management systems that are tailored to user needs;
- Improved management and coordination to promote safe vessel movements and facility siting;
- Improved management of operations and communications in congested areas; and
- Prevention of maritime accidents associated with human factors.

Much of the success of these initiatives relies on the public's awareness of the economic and environmental stakes involved in the marine transportation system. That increased awareness will foster support for a safer, more efficient, and more competitive MTS infrastructure.

Maritime Domain Awareness

Although the events of September 11, 2001 have almost eclipsed the previous focus of Maritime Domain Awareness (illegal narcotics, illegal immigrants, and violations of the Maritime Boundary Line) many of the same resources that are now being mustered to fight the terrorist threat can and likely will be used to counter all maritime threats. Maritime Domain Awareness is, simply

[23] September, 1999 An Assessment of the U.S. Marine Transportation System, Comprehensive US Dept. of Transportation Report to Congress which reviews and assesses the issues and challenges facing the MTS. http://www.dot.gov/mts/docs.htm

put, possessing comprehensive awareness of our vulnerabilities, threats, and targets of interest on the water.

If the US hopes to prevent even worse events than the terrorist attacks against New York and Washington, we must have more knowledge of our vulnerabilities and the threats against us. Therefore, increasing awareness must be a primary concern. Maritime Domain Awareness is a name applied to a more aggressive, more effective means of gathering, using, and sharing information and intelligence than has ever been possible in the past.

It means providing a level of knowledge that is increasingly comprehensive and specific. It means having extensive knowledge of geography, weather, position of friendly and unfriendly forces, trends, key indicators, anomalies, intent, and the activities of all vessels in any area of concern. It means acquiring new data-mining techniques and databases shared across traditional boundaries. It means building on an already-strong cooperative relationship between Canada and the US.

As two nations that depend heavily on the oceans and sea lanes as avenues of prosperity, we know that whatever action we take against further acts of terrorism must protect our ports and waterways and the ships that use them. The US Marine Transportation System (MTS) handles more than 2 billion tons of freight, 3 billion tons of oil, transports more than 134 million passengers by ferry, and entertains more than 7 million cruise ship passengers each year. The biggest challenge facing our MTS is how to ensure that legitimate cargo is not unnecessarily delayed as we and other nations introduce enhanced security measures against very real and potent threats.

Not withstanding the above, trafficking of both illegal narcotics and illegal migrants will remain a major threat in the Pacific as long as the current demand for drugs, and economic disparity between nations, remain unchanged. The drug threat in the Pacific Northwest is also growing. Smuggling of illegal migrants has also proven to be an agile and adaptive form of organized crime that can quickly change methods.

Enforcing the Maritime Boundary Line for fishing is another critical issue. Pacific fish stocks have been dramatically depleted already; without proper enforcement, the Alaskan economy, for example, would be devastated by over-fishing of Bering Sea fish stocks in the US EEZ.

The costs of pollution (e.g., oil and hazardous material wastes, contaminated bilge water, or ballast waters carrying non-indigenous marine species) of our coastal waters are also expected to increase. There is a need for closer monitoring of even routine vessel traffic in response to illegal pumping and dumping. Maritime Domain Awareness will play a major role in understanding the movements of all types of maritime traffic.

Use of Technology and Changes in Design

<u>Automated Identification System (AIS) – An Improvement to Vessel Movement Reporting System (VMRS)</u>

US Vessel Traffic Services (VTS) currently manage vessel movements within their service areas using Vessel Movement Reporting Systems (VMRS; 33 CFR 161). VMRS requires vessels to provide verbal information via a designated radio frequency in sufficient time to allow vessel traffic planning. In Canada, Vessel Traffic Services (VTS) has been combined with the Coast Guard Radio Service (CGRS) into the newly designated Marine Communications and Traffic Services (MCTS). The VTS portion manages vessel movements within their service area under VTS Regulations made pursuant to the Canada Shipping Act (CSA), Part IX, Sections

562.15 and 562.16, R.S.C. 1985. Under the VTS Regulations, vessels are required to provide verbal information via a designated radio frequency in a timely manner for the good order and predictability of vessel traffic movement, to report at designated Calling-In-Points (CIPs), to obtain a traffic clearance, and to maintain a listening watch on the designated VTS radio frequency. The complete West Coast of Canada is covered by VTS through three established VTS Zones and five combined Radio Safety and VTS MCTS Centers. Shared Boundary waters with the United States between British Columbia and Washington State come under the Cooperative Vessel Traffic Service Agreement (CVTS) and are jointly administered by the Tofino MCTS Center, Victoria MCTS Center and the USCG Puget Sound VTS. The CVTS also administers an offshore VTS reporting and vessel screening system through the CCG MCTS Regional Marine Information Center (RMIC) for all vessels inbound to CVTS waters**.**

AIS transponders are intended to automatically provide information including the ship's identity, type, position, course, speed, navigational status and other safety-related information to appropriately equipped shore stations, other ships and aircraft. They also allow equipped vessels to receive such information from similarly equipped ships, as well as to monitor and track ships, through the exchange of data with shore-based facilities. Transmission of the data should be with the minimum involvement of ship's personnel and with a high level of availability. AIS will provide the capability to positively identify and monitor vessel positions and movements for real-time waterways management.

Regulation 19 of Chapter V of the new Safety of Life at Sea (SOLAS) regulations requires AIS to be fitted aboard all ships of 300 gross tonnage and upwards engaged In international voyages, cargo ships of 500 gross tonnage and greater not engaged In international voyages, and passenger ships irrespective of size built on or after July 1, 2002. It also applies to ships engaged In international voyages constructed before July 1, 2002, according to the following timetable:

- Passenger ships, not later than July 1, 2003;
- Tankers, not later than the first survey for safety equipment on or after July 1, 2003;
- Ships, other than passenger ships and tankers, of 50,000 gross tonnage and greater, not later than July 1, 2004;
- Ships, other than passenger ships and tankers, of 10,000 gross tonnage and greater, but less than 50,000 gross tonnage, not later than July 1, 2005;
- Ships, other than passenger ships and tankers, of 3,000 gross tonnage and greater, but less than 10,000 gross tonnage, not later than July 1, 2006.
- Ships, other than passenger ships and tankers, of 300 gross tonnage and greater, but less than 3,000 gross tonnage, not later than July 1, 2007; and
- Ships not engaged on international voyages constructed before July 1, 2002 will have to fit AISs not later than 1 July 2008. A flag State may exempt ships from carrying AISs when ships will be taken permanently out of service within two years after the implementation date.

In all, the revised SOLAS Chapter V on Safety of Navigation has 12 new regulations that reflect changes in technology. In addition, SOLAS Appendices giving an example Record of Equipment for the Passenger Ship Safety Certificate (Form P) and a Record of Equipment for the Cargo Ship Safety Equipment Certificate (Form E) are also revised to take into account the new requirements in Chapter V. [24]

[24] Maritime Safety Committee – Briefing of 73rd session: 27 November - 6 December 2000,

Global Maritime Distress and Safety System / Emergency Position Indicating Radio Beacon

Technology such as the Emergency Position Indicating Radio Beacon (EPIRB) and the Global Maritime Distress and Safety System (GMDSS) take the "search" out of "Search and Rescue." Satellites are used to detect and locate aviators, mariners, and land-based users with such devices onboard. GMDSS is oriented towards providing more effective and efficient emergency response communications, and disseminating Maritime Safety Information (MSI) to all ships on the world's oceans regardless of location or atmosphere conditions. MSI includes navigational warnings, meteorological warnings and forecasts, and other urgent safety related information.

Effective February 1, 1999, both US and non-US flagged vessels must have a current Radiotelephony Certificate, which certifies that the vessel is GMDSS compliant. Exceptions apply to non-US flagged fishing vessels, because SOLAS regulations do not apply to these commercial fishing vessels. US and non-US flagged vessels may have exemptions for GMDSS, EPIRB, or other radio equipment if allowed by the Federal Communications Commission (FCC), USCG, or a non-US flag Administration as applicable.

Vessels required to carry GMDSS and/or EPIRB are[25]:

- Small passenger vessels carrying more than 12 passengers on unrestricted international voyages (US flag);
- All passenger ships on ocean, coastwise, or international voyages (US flagged passenger vessels on voyages less than 20nm from land or, alternatively, that do not go more than 200 nm between consecutive ports, may receive individual exemptions);
- All cargo ships 300 GT and over;
- All self-propelled mobile offshore drilling units 300 GT and over; and
- Fish tender vessels (US and foreign flag), and fish processing vessels (foreign flag) 300 GT and over.

New Vessel Designs

After the *Exxon Valdez* oil spill, Congress promulgated the Oil Pollution Act of 1990 (OPA 90), which intended to "minimize oil spills through improved tanker design, operational changes, and greater preparedness." Section 4115 of OPA 90[26] focuses on ship design, changing the standard from single to double hulls. By 2010, single-hull tankers greater than 5,000 gross tons will be excluded from US waters unless they are equipped with a double bottom or double sides.

New vessel designs combining power and agility are both increasing in number; these new designs both challenge and improve traditional approaches to maintaining navigation safety. For instance, it is not only tractor tugs that now have propulsion capabilities of 360 degrees; Azipod propulsion systems having unlimited 360 degrees are being used on cruise ships, providing better maneuverability and safety.

Cruise lines and container ships are now operating "Mega Ships." Mega cruise ships are 100,000 tons and carry 2,700 passengers. Mega container ships have 6,600 Trailer Equivalent Unit (TEU) capacity, a breadth of 42 meters (approximately 138 feet), which is nearly 10 meters

[25] Safety Of Life At Sea (SOLAS), 1974, as amended in 1988 and Navigation and Vessel Inspection Circular, 3-99 Global Maritime Distress and Safety System (GMDSS) and Emergency Position Indicating Radiobeacon (EPIRB) Equipment Requirements for Commercial Vessels http://www.uscg.mil/hq/g-m/nvic/3_99/n3-99.pdf

[26] Oil Pollution Act of 1990 and 46 U.S.C. 3703a(c).

(roughly 33 feet) wider than the maximum allowed for Panama Canal transit. Such increases in size require larger and better trained crews, improved ports and piers, changes in escort requirements, and often, deeper and specially designated port transit zones. [27]

Fast ferries are becoming a vital component of the international transportation industry. The construction of high-speed craft, such as ferries, has been a boon for the marine design and construction industry. Currently, it is estimated that North American shipyards hold a 30% market share of the worldwide construction orders for High-Speed-Craft (HSC). The International Maritime Organization (IMO) adopted the HSC Code in May 1994 and has been working since to amend the Code to keep pace with HSC's rapid developments.[28]

IMO's Subcommittee on Ship Design and Equipment is also working on revising the Code of Safety for Wing-in-Ground (WIG) Craft, which is derived from the International Code of Safety for High-speed Craft. Since a WIG craft is essentially a high-speed vessel with features of a dynamically supported craft, the proposed draft Code contains principal provisions of the HSC Code relevant to such craft. At the same time, the WIG craft is a flying craft and therefore appropriate provisions of the International Civil Aviation Organization are also incorporated.

International, Federal, and State Regulatory Initiatives

Vessel Response Plans

US federally required Vessel Response Plan regulations (33 CFR Part 155) require response plans for certain vessels that carry oil in bulk as cargo, such as tank ships and barges, with additional requirements for certain vessels operating in Prince William Sound, Alaska. These regulations are mandated by the Federal Water Pollution Control Act (FWPCA), as amended by OPA 90. The purpose of requiring vessel response plans is to enhance public and private sector planning and response capabilities to minimize the impact of spilled oil.

The regulation specifies the different requirements necessary based on distance from shoreline. For example, the quantity of response resources required on board vessels transiting offshore is less than that of vessels transiting nearshore or inland. Required response times vary as well, depending on whether the vessel is inland, offshore, or in the open ocean.

Federal requirements for on-water oil recovery capacity (referred to as "caps") were upgraded with the 2000 Notice of Decision from the US Coast Guard[29]. Presuming technological and operational advances would be made over time, these caps were increased by 25% on April 5, 2000 and the Coast Guard will consider a 2003 cap for mechanical on-water removal capability and requirements for other removal technologies in a subsequent Notice of Proposed Rulemaking.[30]

Other federal and state entities are raising the bar on the daily recovery cap as well. The State of Alaska exceeds the existing Federal cap requirements. US Environmental Protection Agency (EPA) has already implemented a 25% increase in the caps for the OPA 90 response plans required under EPA regulations. The California Code of Regulations recently stipulated that the

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[27] Mega Ships http://web3.asia1.com.sg/timesnet/data/cna/docs/cna1694.html, http://southflorida.bcentral.com/southflorida/stories/2000/10/30/focus2.html
[28] American Institute of Marine Underwriters,
[29] Federal Register: January 6, 2000 [Vol. 64, No. 4; pg. 710-716]
[30] Notice of Decision: Review of Cap Increase, Federal Register January 6, 2000 (Vol. 64, No.4; page 710-716), http://www.uscg.mil/vrp/reg/caps.shtml

on-water recovery rates should be raised by 25% on July 1, 2001, and raised by another 25% on July 1, 2005. [31]

Salvage and Fire Fighting

US federal vessel response plan regulations, 33 CFR 155.1050(k), require tank vessel owners and operators to identify and ensure availability of salvage and marine firefighting resources, with personnel and equipment that can be deployed to a port nearest to the vessel's operating area within 24 hours. [32] However, a public workshop held in August 1997 revealed considerable confusion regarding the correct interpretation of the phrase "equipment and expertise" and considerable debate over the realism of a 24 hour requirement. The 24-hour response time requirement (33 CFR 155.1050(k)(3)) was suspended twice, until February, 2004, in order to allow the Coast Guard time to propose more definitive regulations[33].

The US Coast Guard published a Notice of Proposed Rulemaking (NPRM) to revise the salvage and firefighting requirements for tank ships and tank barges transporting oil in bulk as cargo.[34] The revisions clarify the salvage and marine firefighting services that must be identified in a vessel response plan to ensure an effective response to an incident. The proposed rule would also establish specific response time requirements for those salvage and marine firefighting services.

Rear Admiral Paul J. Pluta, Assistant Commandant for Marine Safety, Security and Environmental Protection, stressed, "The focus of this proposed rule is on public safety and environmental protection. It is designed to put measures in place that will prevent or significantly reduce the amount of oil spilled due to accidents or fire. This ensures that our marine environment is protected while it continues to provide commercial and recreational value for the many families and businesses that use it each day."

Standards of Training and Certification for Watchstanders (STCW)

In 1993, the IMO embarked on a comprehensive revision of STCW regulations to establish the highest practicable standards of competence, in order to address the problem of human error as the major cause of maritime casualties. It was determined that with proper training and enhanced shipboard practices and arrangements, these errors could be largely eliminated. Amendments to the STCW Convention were then made. The most significant amendments concerned:

- Enhancement of port state control;
- Communication of information through IMO to allow for mutual oversight and consistency in application of standards;
- Quality standards governing oversight of training, assessment, and certification procedures;
- Increased responsibility of governing parties, including those issuing licenses, and flag states employing foreign nationals, to ensure that seafarers meet objective standards of competence; and
- Rest period requirements for watch-keeping personnel.

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[31] OSPR's Review of July 1, 2001, 25% Increase to the On-Water Recovery Rates, January 23, 2001,www.dfg.ca.gov/Ospr/regulations

[32] U.S. Coast Guard's Vessel Response Plan and Shipboard Oil Pollution Emergency Plans, 33 CFR Part 155, http://www.uscg.mil/vrp/default.htm

[33] Federal Register: February 12, 1998, Suspension of Regulation on Salvage and Marine Firefighting Requirements; Vessel Response Plans for Oil

[34] The NPRM can be found on the Federal Register, dated May 10th, 2002 (http://www.gpo.gov/su_docs/aces/aces140.html).

The amendments to the training require that seafarers be provided with "familiarization training" and "basic safety training" that includes basic fire fighting, elementary first aid, personal survival techniques, personal safety, and social responsibility. The amendments also require training on use of Automatic Radar Plotting Aids (ARPA) and Global Maritime Distress Safety System (GMDSS) for watch officers. On vessels with these systems, masters and watch officers must also have a thorough understanding of bridge teamwork procedures. In the US, this is understood to be an ability to apply principles of bridge resource management. This renewed focus on the human element should reduce the instances in which human error leads to a maritime casualty or a pollution incident. Mariners must be certified in courses covering these skills and knowledge; the US Coast Guard will audit the courses.[35] The 1995 Amendments to the Convention on Standards of Training, Certification, and Watchkeeping (STCW) are being phased in through August of 2002 internationally and February of 2003 for US domestic vessels.

To ensure that the competency objectives of the 1995 amendments are met, parties must implement quality assurance programs, with IMO reviewing each parties' national program. This represents a fundamental change in thinking for the international community. It will be mandatory that the "pulse" of the new system be checked on a recurring basis to ensure its "good health." In other words, STCW as amended will require all training and assessment activities to be "continuously monitored through a quality standards system to ensure achievement of defined objectives, including those concerning the qualifications and experience of instructors and assessors."

International Safety Management (ISM) Code and Port State Control Programs

The objective of the ISM Code is to ensure safety at sea, prevention of human injury or loss of life, and avoidance of damage to the environment, in particular to the marine environment. The Code requires companies to establish safety objectives, as well as to develop, implement, and maintain a Safety Management System. In a Final Rule published on December 24, 1997, the US Coast Guard implemented the requirements of the ISM code, which applied to both foreign and domestic commercial ships operating in US waters. Compliance with SOLAS, Chapter IX, and the ISM code are mandatory to ships engaged on international voyages regardless of the date of construction, as follows:

- Passenger ships, including passenger high-speed craft, as of July 1, 1998;
- Oil tankers, chemical tankers, gas carriers, bulk carriers and cargo high-speed craft of 500 GT or more, as of July 1, 1998; and
- Other cargo ships and mobile offshore drilling units of 500 GT or more, not later than July 1, 2002.

The 1995 Amendments strengthened the Port State Control provisions of the STCW Convention by expanding the legal grounds on which a foreign ship may be detained and allowing port State Control officers to conduct direct assessments of the competence of merchant mariners.[36] As part of the ISM/Port State Control program, the US Coast Guard has also implemented an initiative to identify high-quality ships, and provide incentives to encourage

[35] USCG's Interim Rule, effective as of July 28, 1997 for Implementation of the 1996 Amendments to STCW, http://www.uscg.mil/SCTW/m-pers.htm

[36] Navigation and Vessel Inspection Circular, 3-98, Port State Control Guidelines for the Enforcement of the 1995 Amendments to the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978 (STCW)

quality operations. This initiative is called *Qualship 21*, for Quality Shipping for the 21st Century.[37] Thus far, efforts to eliminate substandard shipping have focused on improving methods to identify poor-quality vessels. However, regardless of the score that a vessel receives in the USCG "targeting matrix", all foreign-flagged vessels are examined no less than once each year. This provides few incentives for the well-run, quality ship.

Hundreds, perhaps thousands, of vessels are operated responsibly, and are typically found with few or no deficiencies. Under the previous Port State policies, these vessels were boarded at similar intervals as vessels that are not operated responsibly. These quality vessels should be recognized and rewarded for their commitment to safety and quality. As of January 1, 2001, the Coast Guard has implemented the *Qualship 21* program, where those foreign vessels that "qualify" will be awarded with a certificate for reduced examinations; for example the annual freight exam would be extended to once every two years. Passenger ships would still be examined at the same annual intervals but would get a Qualship certificate.

<u>"Coast Watch"</u>
There are many "mystery" spills along the coast that cause oil and tarballs to wash ashore. Environment Canada is currently developing a statistical program on oil signatures that can indicate the exact probability that two samples, identified as a match by chemical analysis, are the same oil. Interest in this new technology has already attracted the attention of countries all over the world, including China and Spain.[38] In addition, the US Coast Guard has had the Central Oil Identification Lab (COIL), now known as Marine Safety Laboratory (MSL), working on oil identification for a number of years.

Canada also conducts regular flying patrols, in partnership with the Canadian Coast Guard and the Air Force, to be on the lookout for any spills. In the US, American Waterways Operators (AWO), as well as oil shipping companies, has partnered to be an intelligence resource for the US Coast Guard in reporting any suspicious activity.

NOAA's Coast Watch program makes images available from a variety of sensors and satellites.[39] These images help meteorologists predict weather, fishermen locate fish, and scientists track oil spills. The use of this program by mariners, commercial shipping pilots and the general public is growing. On the West Coast, a project particular to Point Reyes - "California's Tarball Incidents" - is under development to address reduction of chronic oil pollution. This project will also rely on regular aircraft surveillance of shipping lanes and satellite coverage/analysis to detect the presence of oil slicks or vessels discharging oil.

<u>West Coast State Initiatives Regarding Emergency Towing and Salvage</u>:
The State of California has regulations that require both tank vessels and non-tank vessels to demonstrate emergency towing and salvage capability as part of their oil spill contingency plans. These salvage requirements were effective in 2000 for tank vessels and will be effective in 2002 for non-tank vessels. California regulations require that salvage availability be demonstrated by either in-house capacity or by a signed valid contract with a salvage company capable of providing a professional salvor, firefighting capability, and necessary equipment. Within 12 hours of notification that a vessel is disabled, or before a possible grounding (estimated as a function of worst-case wind drift data) a support vessel capable of stopping the

[37] For more information on Qualship 21, go to: http://www.uscg.mil/hq/gm/pscweb/qualship.htm.
[38] Environment Canada, http://www.ec.gc.ca/science/sandemar99/article4_e.html
[39] NOAA Coast Watch http://coastwatch.noaa.gov/

vessel's drift must be on-scene. Within 18 hours of notification, equipment must be on-scene that is necessary to tow an incapacitated vessel to a safe haven. The State of Washington is considering adoption of a similar requirement as it reviews its current contingency plan requirements. Either state will review their salvage regulations following adoption of similar federal salvage regulation, and if such a state rule were found to be redundant or preempted, it would be repealed.

A Dedicated Rescue Tug at Neah Bay

The Washington Legislature appropriated $1.65 million during the 2000 legislative session to establish a rescue tug at Neah Bay during the 2000-2001 winter season, near the entrance to the Strait of Juan de Fuca, that could assist disabled commercial vessels and prevent major oil spills. The 2000 supplemental budget provision stated:

> "$1,650,000 of the general fund appropriation for fiscal year 2001 is provided solely to the oil spill administration account to be used for a rescue tug. By December 1, 2000, the department shall report to the appropriate fiscal committees of the legislature on the activities of the dedicated rescue tug. The report shall include information on rescues, assists, or responses performed by the tug. The report shall also indicate the class of vessels involved and the nature of the rescue, assist, or response."

The Department of Ecology's report, *Neah Bay Rescue Tug Report to the Washington State Legislature,* is available on their web site.[40] The report provides a historical perspective, discusses the need for spill prevention, describes tug operations over the last three winter seasons and makes a recommendation for future funding. The report recommends that a dedicated rescue tug be permanently stationed at Neah Bay and supported by federal funding. It further recommends that the Washington Legislature continue state funding through the 2001-2003 Biennium, or until federal funding is secured. If long-term federal funding is not secured, then the state would proceed with rulemaking to determine whether vessels transiting these waters should have a user-fee-supported rescue tug available.

The 2001 and 2002 Washington Legislatures also appropriated funding for a dedicated Neah Bay rescue tug during subsequent winter seasons. The Department of Ecology prepared a supplemental report in 2002 which is also available at the web site noted in the footnote #40.

Non-Tank Vessel Contingency Planning

The Canada Shipping Act requires that all vessels in Canadian waters have contracted spill response coverage with an approved oil spill response organization; in British Columbia this would be Burrard Clean Operations. Such coverage does not include emergency towing or salvage, however. All West Coast states require tank vessels to provide oil spill contingency plans. The states of Washington and Oregon have also required oil spill contingency plan coverage for non-tank vessels since 1991. California adopted similar non-tank regulations in 1999, and Alaska did so in 2001. To the extent that such plans include a salvage regulation like California's, these requirements may reduce the threat of drift groundings from vessels calling on ports or otherwise entering the waters of these jurisdictions.

Financial Responsibility Requirements

As re-emphasized in the US v. Locke Supreme Court decision in 2000, states are not preempted by federal authority from requiring that vessels operating in state waters be liable for all costs and damages associated with an oil spill. Among the West Coast states, California has set the highest of such financial responsibility requirements. Tankers and large tank barges

[40] www.ecy.wa.gov/biblio/spills.html.

operating in California waters must provide a certificate of financial responsibility of up to $1 billion. Non-tank vessels must meet a $300 million level. Other West Coast states currently have lower financial responsibility requirements, but are considering raising them in some cases. The State of Oregon's experience with the M/V *New Carissa* grounding and oil spill led to consideration of establishing a higher level than its current amount, which is equivalent to that in OPA 90 (the greater of $500,000 or $600/gross ton). Washington's non-tank vessel financial responsibility level is also the same as that in OPA 90, and was also under reconsideration during the 2001 Washington legislative session, as is its financial responsibility requirement for tank vessels. It is hoped that such requirements would contribute to a general awareness among West Coast vessel operators of the need for precautions to avoid drift groundings and associated oil spills.

C. POSITIVE TRENDS

Despite the recent growth in the US maritime trade, and the increasing congestion of our ports, accident rates are going down and the amount of oil released in the marine environment is declining as well. The number of major spills in the US has dropped 50% from pre-1991 levels, and there have been no spills larger than a million gallons off our coasts since that time (in contrast to over a dozen spills of one million gallons or more in the rest of the world). The number of gallons of oil spilled per million of gallons shipped has dropped 64% from the pre-OPA 90 era. In 1999, the volume and number of vessel spill incidents continued the downward trend that began in the early 1980's (with exception of peaks in 1989 and 1990). The United State's preparedness for oil spills is at an all-time high.

In the US, Eighty-seven percent of all the spills that occurred from 1973 - 1999 were between 1-100 gallons. There is a general downward trend in the number of spills over 1,000 gallons; 67.1% of the volume of spills by spill size from 1973 - 1999 were as a result of spills greater than 100,000 gallons. However, there have been no oil spills larger than one million gallons by volume between 1991 and 1999. [41] These positive trends may be attributed to several factors:

- Vessels are generally safer both in operation and design as higher standards have come into force. The likelihood of these vessels drifting uncontrollably to shore is further reduced;
- Technology, including navigation and safety systems, has improved substantially allowing greater margins of safety, which contribute to reduced risk of environmental damage; and
- Perhaps most importantly, many in the shipping industry have recognized that environmental responsibility is financially practical, particularly in the face of stiff penalties for non-compliance and stringent liabilities for accidents.

[41] Oil Spill Intelligence Report (December 2000) -- International Oil Spill Statistics for 1999 and Cumulative Data and Graphics for Oil Spills 1973-1999 http://www.uscg.mil/hq/g-m/nmc/response/stats/Summary.htm

Part IV. Analysis of the Risk

TUG RESPONSE TIME MODELING

One of two major tasks for this project was to analyze the effects of environmental forces on a vessel that has been disabled and to determine how quickly an assist vessel could reach that disabled vessel at various locations on the West Coast of the United States and British Columbia.

This tug response time analysis does not attempt to measure any probabilities or risk of vessels experiencing a casualty that could result in a drift-grounding. The response model's operating hypothesis is that a vessel has suffered a non-repairable casualty that will result in a drift-grounding unless outside assistance is provided. The purpose of this analysis was to analyze the ability of assist vessels - from West Coast ports where at least one rescue vessel of sufficient size is available - to reach a vessel in time to stop her drift. The model does not take into account vessels of opportunity such as military, United States Coast Guard vessels on patrol, or other merchant vessels in transit. These vessels of opportunity could further enhance any vessel stabilization capability.

The first step in this modeling process was to use the information provided by NOAA that determined maximum and mean wind conditions on the West Coast (Appendix J). Wind conditions were divided into five geographic regions from Alaska to the southern border of California. Ocean currents were determined to be generally parallel to the coast but did not have a significant on shore component.

Drift data for various types of hulls varied between 2-10% primarily depending upon a ship's hull type and load conditions. A 9% drift factor was used as a "worst case" for this drift analysis. Using wind speed zones and a drift factor of 9% a vessel drift rate was established and incremental drift lines were constructed.

The second step of the process was to construct concentric speed of advance (SOA) circles from West Coast Ports where assist vessels of sufficient size were located and available for tug assist/rescue of disabled vessels. A speed of advance (SOA) of ten knots was modeled for the assist vessel.

To account for varying times and distances to proceed from harbor moorings, an artificial buffer zone (in miles) was added to the disabled vessel drift lines; this buffer zone accounted for the time it would take an assist vessel to clear the harbor as well as the distance the disabled vessel would drift in that time frame.

Estimated Tug Distances and Times from Selected West Coast Ports

Location	**Latitude** (degrees-minutes-seconds North)	**Longitude** (degrees-minutes-seconds West)	**DeciLat** (Degree)	**DeciLong** (Degree)	**Estimated distance from harbor entrance** (nautical miles)	**Estimated time from harbor entrance**
San Diego, at Pt. Loma	32-39-54	117-14-30	32.66500	-117.24167	5.5	.5 hour
LA/LB at Pt. Fermin	33-42-20	118-17-36	33.70556	-118.29333	5.5	.5 hour
San Francisco sea buoy	37-45-0.0	122-41-36	37.75000	-122.69333	18	2 hours
Columbia River entrance buoy ("CR")	46-11-05	124-11-03	46.18472	124.18417	64	6 hours; 2 to man a tug and 4 hours travel time from Rainier
Puget Sound at "J" Buoy	48-29-12	124-43-42	48.48667	-124.72833	See note 1 below	5-6 hours from Port Angeles, 10-12 from Seattle, 8 -10 from Vancouver
Valdez at Cape Hinchenbrook	60-14-18	146-38-48	60.23833	-146.64667	See note 2 below	1 hour from Hinchinbrook, 5-6 from Valdez

1. 55 miles from Port Angles, 63 miles from Victoria, 95 miles from Anacortes, 125 miles from Seattle
2. 10 miles from Hinchenbrook Island, 62 miles from Port Valdez

After drift rate lines and rescue/assist SOA circles were constructed, the intersection of matching drift lines and circles were plotted. The resulting line shows the boundary that a vessel would have to remain seaward of in order to be rescued before drifting ashore. If a vessel transited inside that boundary, then the rescue vessel would not be able to reach it before a drift-grounding occurred.

This process and the drift contours for both mean and maximum wind conditions are shown in Appendix J. This information was incorporated into the Relative Ranking/Risk Indexing model described below.

RISK ASSESSMENT MODEL DEVELOPMENT

Basic risk management steps include:

1. Setting a goal
2. Collecting the data
3. Developing a Risk Assessment model (Applying the data to the model)
4. Implementing risk management principles
5. Assessing the results, or impact, of the risk management principles over time

The Workgroup's goal was to reduce grounding/collision risks from offshore vessel traffic on the West Coast of the United States and Canada. The next step in accomplishing this task was to develop a risk assessment model. Once the results of the model were determined, the Workgroup could determine if the present risks were acceptable or recommend steps to reduce the risks. In developing a risk model for the Workgroup, six types of risk assessment models utilized by the US and Canada were reviewed. These included the:

1. Ports and Waterways Safety Assessment Guide (PAWSA)
2. Waterway Evaluation Tool (WET)
3. Oceans Risk and Criteria Analysis (ORCA)
4. US Coast Guard Model for Moored Passenger Vessels
5. US Coast Guard Marine Safety Office Jacksonville Model
6. US Coast Guard Marine Safety Office/Group Los Angeles/Long Beach Model

The PAWSA, WET, and ORCA models were not employed due to their complexity and need for additional data not requested by the group. Of the three Coast Guard models examined, the Marine Safety Office/Group Los Angeles/Long Beach's model proved most adaptive to the Workgroup's needs, due to its ability to easily display and categorize the various risk data fields. It is important to note, however, that elements of all of the models were used to develop the Workgroup risk assessment. What the Workgroup ended up with is sometimes referred to as the "Relative Ranking/Risk-Indexing" method.

The US Coast Guard has guidelines on Risk-Based Decision-Making (RBDM) methodologies in support of its Marine Safety and Environmental Protection program[42]. Relative Ranking/Risk-Indexing is one of the tools in RBDM. The RR/RI technique assesses the attributes, for example, of a vessel, operation, etc., to calculate risk index numbers. The USCG's Port State Control targeting matrix is a prime example of using the RR/RI tool.

An RR/RI is a systematic process, generally performed by a small group who are not necessarily risk experts. It is based mostly on interviews, documentation reviews, and field inspections, and is a technique that generates, 1) index numbers that provide an ordered list of priorities, and 2) lists of attributes that are the dominant contributors to problems.
The steps to Relative Ranking/Risk Indexing are as follows:

1. Define scope of study
2. Select ranking tool
3. Collect scoring information
4. Calculate ranking indexes
5. Use the results in decision making

It is important to understand the limitations of the RR/RI methodology:

- Results cannot always be tied to absolute risks; instead, results define relative values of risk such as higher, lower, and average; and
- The methodology does not account for unique situations; with the number of variables at play in any collision/grounding scenario, obviously the Workgroup could not have thought of every possible scenario.

Besides remembering the limitations to an RR/RI, another note of importance is validating the indexing model and refining it as needed. There are two ways to do this:

1. Statistical evaluation -- uses historical data to create several scenarios for testing the indexing tool. The results of the tool can then be compared with the actual historical outcomes; or
2. Simple consensus -- a group of subject matter experts creates scenarios and evaluates whether the tool generates an appropriate index number or action. This is the method we used. As explained below, Workgroup members from Alaska, BC, Washington,

[42] The USCG's Risk-Based Decision-Making website can be found at: http://www.uscg.mil/hq/g-m/risk

Oregon, and California developed and ranked scenarios which defined our threshold values; this process validated the model.

The following steps were taken to implement the model; these are explained below:

1. Determined the scoring information by interpreting all the collected data into various factors that contribute to drift grounding/collision oil spill risk.
2. Assigned a risk-indexing value for each risk factor (1 to 10 points possible).
3. Calculated the relative ranking indexes to represent the degree of risks (lower, average, and higher relative risk levels).

Determining the scoring information

The Workgroup examined the data collected along with other significant and quantifiable factors that could affect ship safety. This resulted in a decision to use the following nine risk factors:

1. *Volume of Oil/Vessel Design Factor* – Ranked the major types of ships for which data were collected, including tankers, tank barges, cargo vessels, passenger vessels, and large fishing vessels. This factor included a "credit" for vessels with redundant propulsion/steering systems.
2. *Drift Factor* – Ranked the ability of the vessel to drift due to the amount of sail area.
3. *Higher Collision Factor* – Ranked the risks vessels incur due to transiting through restricted or hazardous areas or across traffic lanes.
4. *Distance Offshore Factor* – Ranked the risk of oil spill due to a vessel's distance from land. This factor included "credits" for compliance with existing management measures.
5. *Weather/Seasonal Factor* – Ranked the risk of damage/sinking of a vessel due to its geographic location on the West Coast (Alaska to California) during each season.
6. *Tug Availability Factor* – Ranked the time a pre-positioned tug could respond to an offshore vessel needing assistance, as modeled in the tug response time analysis.
7. *Coastal Route/Density Factor* – Ranked the risk posed to vessels due to the amount of vessel traffic off specific sections of the West Coast.
8. *Historical Casualty Factor* – Ranked the risk posed by vessel types due to the number of casualties experienced over an eight-year period.
9. *Environmental Sensitivity Factor* – Ranked the impact of an offshore spill on environmentally sensitive areas.

Assigning the risk-indexing value

The maximum risk-indexing value was determined in order to set a numerical range for recording the risks. The Workgroup agreed that the maximum index value factor for each risk factor category would be ten. Subsequently each risk factor would be ranked from one to ten.

Utilizing the professional expertise of the Workgroup, each of the nine risk factors was broken down into individual elements. Each element was assigned an appropriate numeric risk-indexing value as follows:

1. Lower Risk: Values of 1 to 3 points
2. Average Risk: Values of 4 to 6 points
3. Higher Risk: Values 7 to 10 points

In addition, the Workgroup agreed to recognize some of the positive practices taken by the maritime industry to reduce risk, and subsequently added some offsetting features to two of the risk factors (Volume of Oil/Vessel Design Factor and Distance Offshore Factor) addressing these practices (see above)

Calculating the relative ranking index

Once the risk-indexing model was created, the Workgroup evaluated several scenarios to validate the model. In order to obtain a good average median, each regional group (Alaska, British Columbia, Washington/Oregon, and California) was tasked with developing a number of specific risk scenarios appropriate for their regions, utilizing the risk matrix (Please reference Appendix L). The results are as follows:

Area	***Number of Scenarios***	***Range of Points Total***
Alaska Region	11 (x 3 seasons)	30 - 57
British Columbia Region	10 (x 3 seasons)	20 - 63
Washington/Oregon Region	16 (x 3 seasons)	33 - 69
California Region	15 (x 3 seasons)	25 - 66
Total	52 (x 3 seasons)	**20 - 69**

The table above shows the lowest value to be 20 and the highest value to be 69, which represent what may be the typical range of points possible with this model. Alone, these index values are simply numbers. Therefore, in order to define the levels of relative risk, the following thresholds were assigned:

Weighted Score	
Lower Risks	20 - 36 points
Average Risks	37 - 52 points
Higher Risks	53 - 69 points

These thresholds allow the Workgroup, upon completion of the risk analysis, to next concentrate its efforts on identifying and reducing the risk on the higher risk vessels and/or areas. In order to visually display the information on the risk-indexing matrix, a color scheme of green, yellow and red representing lower risk, average risk, and higher risk, respectively, are used.

RISK SCENARIOS & RESULTS

Subcommittees of Workgroup members from each geographic region developed typical risk scenarios for their respective geographic areas (Appendix L). After scoring each scenario using the risk-indexing matrix, the scenarios were sorted according to their risk categories as follows:

Region	**Number of Scenarios**	**Higher Risk Scenarios**	**Average Risk Scenarios**	**Lower Risk Scenarios**
Alaska	33	5	26	2
British Columbia	30	10	14	6
Washington and Oregon	48	36	11	1
California	45	15	26	4
Total	**156**	**66**	**77**	**13**

The higher and average risks were plotted to obtain a visual display. However, in order to exhibit the risk for an entire geographic region, the scenarios were expanded. Additional reference points at more frequent intervals were chosen for each geographic area. The risk model was applied for all chosen vessels types, transiting off the coast at fixed distances of <12, 15, 25, 50, 75, and 100 nautical miles from these reference points. This resulted in creating 1,296 additional scenarios; these were plotted and connected to map the offshore risk. This "macro" image greatly assisted the Workgroup in identifying the relative offshore risks areas for the entire region.

A visual display of the results, which portrays coastal areas outlined as color zones indicating the relative risk levels (red zone = higher risk, yellow zone = average risk) is provided in Appendix L. Laden tankers, cargo vessels and passenger vessels generally proved to have the same results, so these categories were grouped together. Laden tank barges and fishing vessel results varied greatly, and are displayed separately. These pictorial displays represent scenarios where the vessels are single hulled, laden and transiting in winter, so it is important to note that these depict only the worst case scenarios. The numbers in the tables of Appendix L depict the entire range of possibilities, especially the greatly reduced risk levels if a tank vessel were double-hulled, and can be used to describe more typical or "average" case scenarios.

Part V. Development of Findings and Recommendations

At their meeting on April 23-24, 2001 the Workgroup agreed to ask the Task Force and the US and Canadian Coast Guards to extend their mandate for one more year in order to develop risk management recommendations. In order to identify the risk factors upon which they would focus in order to do so, CDR Uberti led the Workgroup in a review of the risk factors that contributed to the Higher Risk Scenario scores for each jurisdiction. All risk factors contributed to some degree, but ranked according to the frequency of contribution from higher to lower, the factors were: weather, environmental sensitivity, distance offshore, collision hazard, traffic density, historic casualty rates by vessel types, drift rate, vessel design, and tug availability.

Reviewing those risk factors most likely to be mitigated by actions which the Workgroup might recommend, the group chose to focus on the following four:

The Distance Offshore Risk Factor: The risk of grounding decreases with greater distance offshore. The Subcommittee addressing this topic was chaired by Stan Norman.

The Higher Collision Hazard Risk Factor,

Part A: Risk of collision increases with traffic density at approaches to ports. Follow-through on this issue was managed by CDR Uberti & Gordon May.

Part B: Risk of collision may increase with offshore traffic density between ports. This subcommittee was chaired by Sven Eklof.

The Tug Availability Risk Factor: Risk of drift grounding decreases with rescue vessel availability & capability, and is significantly impacted by weather conditions. This subcommittee was chaired by Jerry McMahon.

The Historical Casualty Risk Factor: Risk increases for vessels types that have relatively higher casualty rates. This subcommittee was chaired by USCG LCDR Jane Wong.

The Workgroup and Subcommittees agreed to use the following criteria in reviewing potential recommendations:

- A recommendation is supported by the data in the study;
- It is realistic, meaning capable of being implemented with available technology and expertise within a reasonable timeframe;
- It would be effective, meaning providing real protection to the environment, not just the appearance of protection;
- It would be economically feasible, meaning capable of being implemented without imposing unreasonable cost increase on vessel owner/operators, their customers, or ports; and
- It would be flexible, meaning allowing for improvements and changes in technology and policies.

The Workgroup also agreed to utilize outside expertise where necessary, such as ship masters and/or VTS operators with current experience to assist in the evaluation of needs. In addition, they agreed to consider all options or recommendations, and consider whether existing management measures and the recommendations work together in a consistent regime. The Subcommittees agreed to stay focused on the “higher risk” areas identified.

The Task Force (known as the “Pacific States/British Columbia Oil Spill Task Force after July of 2001) and the Coast Guards agreed to extend the Workgroup for one more year. The

Subcommittees noted above brought recommendations to the full Workgroup at their meeting in San Diego in October. There, and during subsequent conference calls, the Workgroup agreed to a set of draft Findings and Recommendations on these four topics, as well as on the need for improved data and long-term implementation monitoring.

These draft Findings and Recommendations were then made available for public comment. Rick Holly, CDR Uberti, the Workgroup members, and Jean Cameron (Task Force Executive Coordinator) gave presentations on the Project and draft recommendations to the following groups from December 2001 through March of 2002. :

- The Alaska Regional Response Team
- The Cook Inlet Regional Citizens' Advisory Council Board of Directors
- The US Coast Guard Navigation Safety Advisory Council
- The Columbia River Ports and Waterways Safety Committee Meeting
- The Olympic National Marine Sanctuary Advisory Council
- The San Diego Harbor Safety Committee
- The NW Regional Response Team and Area Committee
- The California Oil Spill Technical Advisory Committee
- The Los Angeles Harbor Safety Committee
- The Western States Petroleum Association's Marine Subcommittee
- The Puget Sound Harbor Safety Committee
- The San Francisco Harbor Safety Committee
- The Western Marine Community, Pacific Coast Marine Review Panel of Vancouver, British Columbia
- The California Coastal Commission
- The Canadian Maritime Advisory Council
- The California State Lands Commission Customer Service Meeting
- The Humboldt Bay Harbor Safety Committee; and
- The American Waterways Operators, Pacific Region

In addition to these presentations, the draft Findings and Recommendations were also published in the Task Force's January 2002 newsletter, available on the Pacific States/BC Oil Spill Task Force web site.

Public comments on the draft Findings and Recommendations were received until March 31st, and were reviewed and discussed by the WCOVTRM Project Workgroup at their April 2002 meeting, prior to adoption of their final Findings and Recommendations. These comments, and the Workgroup's responses, are summarized in Appendix N.

Final Findings and Recommendations were adopted by the Workgroup at their last meeting on April 25-26, 2002 in Vancouver, BC. The Workgroup then worked with the Task Force's Executive Coordinator on development of the final project report. Their Final Project Report and Findings and Recommendations will be presented to the Pacific States/BC Oil Spill Task Force Members at their July 2002 Annual Meeting. Jean Cameron and Rick Holly will work with the US and Canadian Coast Guards to present the Final Project Report and Findings and Recommendations to their executive officers as well. The Task Force's Coordinating Committee met with US Coast Guard Pacific Area marine safety officers in May of 2002 and began the process of discussing steps to implement the Workgroup's recommendations. This process will continue through 2002 and into 2003 as needed.

Part VI: Findings and Recommendations

I. <u>Findings and Recommendations regarding Collision Hazards on the West Coast</u>

1. The West Coast Offshore Vessel Traffic Risk Management Project Workgroup finds that the risk of vessel collisions increases with traffic density. One area of increased traffic density is at port entrances. The West Coast Offshore Vessel Traffic Risk Management Project Workgroup therefore recommends that Harbor Safety Committees or their equivalents in West Coast ports continuously monitor this risk and evaluate the need for enhanced traffic safety systems at their port entrances.

2. Based on their survey of coastal transits for July of 1998 through June of 1999, the West Coast Offshore Vessel Traffic Risk Management Project Workgroup finds that coastwise traffic density is higher along the section of the West Coast between the Strait of Juan de Fuca and Los Angeles/Long Beach than either north of the Strait or south of LA/LB. The coastal sections of highest density within this area are those between the Strait of Juan de Fuca and the Columbia River, and between San Francisco and Los Angeles/Long Beach.

   While we recognize that the transit numbers for that period represent only one snapshot in time, according to our best professional judgment we foresee no major changes to that relative volume pattern. The West Coast Offshore Vessel Traffic Risk Management Project Workgroup anticipates that the pending AIS carriage requirement, when fully implemented, could significantly reduce any collision hazard in these areas of high traffic density. We therefore recommend that the maritime and towing industry operating on the West Coast consider implementing compatible Automatic Identification System (AIS) carriage in advance of the required schedule.

   Because the Workgroup feels that AIS carriage will be adequate, we find that the risk of collisions associated with these traffic densities does not justify a recommendation for a traffic control scheme covering the entire West Coast. This finding is not intended to preempt local decisions to monitor compliance with traffic separation schemes or Areas To Be Avoided or future decisions to use AIS data to track vessel traffic patterns.

3. The West Coast Offshore Vessel Traffic Risk Management Workgroup finds that different offshore ballast water exchange standards have been adopted by California, Oregon, Washington, and various Canadian west coast ports (under the auspices of the Transport Canada publication “Guidelines For The Control Of Ballast Water Discharge From Ships In Waters Under Canadian Jurisdiction”). Although the Project Workgroup does not find that these differing standards impose an increased risk of collision offshore, we recommend that the US Coast Guard, in consultation with Fisheries and Oceans Canada and Transport Canada, and consistent with IMO actions, adopt a single set of preemptive national or regional offshore ballast water exchange standards that would enhance the consistency of navigation for the purpose of ballast water exchange on the West Coast.

II. <u>Findings and Recommendations regarding Historic Casualty Factors</u>

Vessel casualty data collected for this study indicate that there were over 800 reported marine casualties involving vessels 300 gross tons or larger along the West Coast of North America from 1992 to 1999. Pro-rated for a one year period, which is the length of time for which we collected transit data, this number represents approximately 0.52% of all vessel arrivals on the

West Coast. It is worth noting that, since foreign flag vessels are not required to report casualties which take place outside of the 12 nm territorial sea, the total number of reported casualties within our study area may have been less than the actual number that occurred. Ninety-six of these casualties fall within the scope of this report as "offshore" (3-200 nm) casualties which had the potential to cause a significant oil spill. Pro-rated for a one-year period, this represented 0.062% of all vessel arrivals on the West Coast. These casualties ranged from mechanical failures to collisions or groundings -- basically, any incident that may have caused an oil spill of 1000 gallons or more. Overall, the Workgroup found that incidents involving mechanical and equipment failures do occur off the West Coast with enough regularity - an average of 12 times/year over the study period - to justify our concern that such incidents could result in drift groundings and the release of oil or other hazardous materials into the environment.

1. The Workgroup finds that a heavy concentration of reported casualty positions near major ports can be discerned as one trend. This may be attributed to higher traffic density in these areas, as well as to the fact that ships conduct their status review of steering and propulsion systems 12 hours prior to entering US waters. Therefore the incidents are reported and monitored closely (loss of steering was the most common type of equipment failure). The USCG Marine Safety Office Puget Sound has worked with the Puget Sound Steamship Operators Association to develop a recommended “Standard of Care” covering maintenance procedures, preventive measures, and actions in the event of a power loss. The Workgroup recommends adoption of a similar Standard of Care by other West Coast US ports and encourages Canadian authorities and industry to examine the applicability in Western Canadian waters as well.

2. The Workgroup also finds that cracks and fractures in tank vessel cargo tanks were the most common type of structural failure identified in the casualty data. Structural stress for the Trans-Alaska Pipeline System (TAPS) trade tankers is not unusual, considering that these tankers routinely transit through the harsh environment of the Gulf of Alaska. Moreover, TAPS tankers are subject to very stringent inspection and reporting standards, which may skew the reported vessel casualties to include a high number of tanker incidents. The Workgroup anticipates that such incident frequency will decrease as new double-hull replacements come on line for the existing TAPS fleet. The Workgroup recommends continued vigilant application of the Critical Area Inspection Program (CAIP) by the US Coast Guard as the TAPS fleet ages, and encourages TAPS tanker operators to consider expedited replacement schedules.

3. The Workgroup also found that cargo/freight ships had the highest number of casualties overall, but notes that this vessel type also represents the greatest number of offshore transits. The resultant overall rate of casualties per transits of 0.054% for cargo/freight ships represents a low average casualty risk. We note that these vessels are subject to national and international safety and environmental regulations, as well as to our recommendations on AIS carriage and on maintaining a voluntary recommended minimum distance offshore.

4. Fishing vessels also ranked high in the mechanical/equipment failure category; their overall rate of casualties per transits was 0.384%. Based upon the Workgroup’s examination of existing and proposed programs sponsored by both government and the fishing industry to improve safety overall, the Workgroup recommends implementation of

the US Coast Guard's Commercial Fishing Vessel Safety Action Plan.[43] The Workgroup also recognizes the State of Washington's Fishing Vessel Inspection program as a good model for fishing vessel inspections, since it focuses on reducing accidents caused by human error. [44]

5. The Workgroup looked into casualty rate reductions to be expected as a result of implementation of the International Management Code for the Safe Operation of Ships and for Pollution Prevention (ISM Code), which is being phased in through July of 2002, as well as the 1995 Amendments to the Convention on Standards of Training, Certification, and Watchkeeping (STCW) which are being phased in through August of 2002 internationally and February of 2003 for US domestic vessels. The Workgroup finds that any risk reduction trends attributable to these measures should be discernable after full implementation.

III. Findings and Recommendations regarding Rescue Tug Availability on the West Coast

1. Based on a 2000-2001 inventory, the West Coast Offshore Vessel Traffic Risk Management Project Workgroup found that approximately 182 ocean-going tugs operate out of West Coast "home ports. " Of these, 77 were found to be capable of severe weather rescues based upon our analysis of existing studies on the bollard pull necessary to operate in such conditions. The Project Workgroup further finds that the capability of potential rescue vessels on the West Coast has improved greatly in recent years with the construction and placement of numerous state-of-the-art tugs with greater horsepower, maneuverability and technologically advanced equipment.

2. The West Coast Offshore Vessel Traffic Risk Management Project Workgroup conducted an analysis of the probable response times of these rescue tugs from their home ports under both average and worst case wind conditions, assuming that a disabled vessel is drifting towards shore and no other means is available to stop its drift. This analysis defined response time contours which varied from 15 to 216 nautical miles offshore, depending upon various model variables. This information was used in the Relative Ranking/Risk Indexing model to define higher risk areas on the West Coast.

3. The West Coast Offshore Vessel Traffic Risk Management Workgroup finds that the International Tug of Opportunity System (ITOS), which operates in the US/Canadian transboundary waters of the Strait of Juan de Fuca and Puget Sound, and which covers the coastline of British Columbia as well, provides information on the location and basic capabilities of ocean-going tugs. This information supplements tug location information available through the Vessel Traffic Service (VTS) system for that area.

4. The Workgroup finds that it would be beneficial to enhance tug location and capability information coastwise. The Workgroup recognizes that International Maritime Organization (IMO) mandated AIS carriage, as well as US domestic requirements for

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[43] See copies of Proceedings of the Marine Safety Council, April – June 2001, pages 61-62 at http://www.uscg.mil/hq/g-m/nmc/pubs/proceed/q2-01.pdf. The eight long-term action items identified in the plan include completing a regulatory project on stability and watertight integrity for certain fishing vessels; improving casualty investigation and analysis; mandatory vessel examinations; and mandatory training-based certificate programs for operators and crew.

[44] Washington's inspection standards for fishing vessels can be found at http://www.ecy.wa.gov/programs/spills/prevention/Fishing%20Vessel%20Accepted%20Industry%20Standards.pdf

AIS carriage, should be in place for tugs no later than 2008, or 2004 as currently proposed by pending US legislation. The Workgroup therefore recommends that the US Coast Guard evaluate whether the information to be available through AIS carriage will provide equivalent or better tug location and capability information than that provided by ITOS. If so, the US Coast Guard should take steps to ensure that this information on possible rescue tug locations is made available to all Captains of the Port on the West Coast. If not, or if the carriage requirements are not implemented by 2008 at the latest – optimally by 2004 – we recommend that the US Coast Guard consider placing transponders on ocean-going tugs not already carrying them, and adding signal receiving stations as needed to establish a coastwise network for information on ocean-going tug locations.

5. Where the tug availability risk factor is high due to a lack of readily available severe weather rescue tugs as identified by our tug homeport analysis, the Workgroup recommends several measures or combinations of measures for consideration by local jurisdictions to reduce that risk, including investment in a dedicated rescue tug, creation of a stand-by tug fund, or adoption of regulations requiring rescue tug contracts held by vessel operators.

   We find that dedicated rescue tugs are expensive investments[45] and that funding schemes vary from federal funding in the UK, France, and South Africa to private funding for a tug stationed at Cape Hinchinbrook, Alaska, to state funding for a tug stationed at Neah Bay, Washington during the winter months[46].

   Regarding a regulatory approach, we find that the US Coast Guard is developing salvage contract requirements as part of the oil spill contingency plans covering tank vessels; their final rule is not expected to be completed until 2004. The State of California has salvage and rescue tug contract requirements that applied to tank vessel contingency plans effective 7/1/2000, and similar regulations that will apply to non-tank vessel contingency plans effective 7/1/2002.

   Another possible measure is a stand-by fund. In the US, such a fund could be supported by both state and federal appropriations that provide funding for a Captain of the Port decision to require an assist tug(s) when circumstances warrant such a preventive measure. In Canada, authority exists to require a rescue tug to stand-by a vessel if the threat of pollution is imminent; the resulting cost is then the subject of legal interpretation. Canadian authorities could consider use of a stand-by fund to cover the cost of such cases.

IV. <u>Findings and Recommendations regarding the Distance Offshore Risk Factor</u>

1. The West Coast Offshore Vessel Traffic Risk Management Project Workgroup finds that the risk of a grounding/collision generally increases the closer a vessel transits to shore. Using a relative ranking/risk-indexing model that incorporated nine risk factors (volume of oil/vessel design factor, drift factor, higher collision factor, distance offshore factor, weather/seasonal factor, tug availability factor, coastal route/density factor, historical casualty factor, and environmental sensitivity factor), the Workgroup mapped areas of higher risk along the West Coast of Canada and the United States. The resulting higher

[45] $2,555,000 annual operating costs were estimated (based on $7000/day for the tug at Neah Bay), which is only on station for a six month period.
[46] The State of Washington has recommended that the federal government share funding of the tug.

risk area line was generally no more than 25 miles from land along the entire West Coast, except off Southeast Alaska, off Northwest BC, and off Point Arguello in California, where it extended to 50 nm offshore in those cases. The workgroup finds that vessels transiting within these higher risk areas have a greater potential for a grounding due to one or more of the risk criteria than if they transited offshore of these areas.

2. The West Coast Offshore Vessel Traffic Risk Management Project Workgroup recommends that, where no other management measure such as Areas to Be Avoided (ATBAs), Traffic Separation Schemes (TSSs), or recommended tracks already exist, vessels 300 gross tons or larger transiting coastwise anywhere between Cook Inlet and San Diego should voluntarily stay a minimum distance of 25 nautical miles (nm) offshore.

3. For the sake of consistency with existing agreements, the Workgroup further recommends that, where no other management measures such as ATBAs, TSSs, Tanker Exclusion Zones, or recommended tracks already exist, tank ships laden with crude oil or persistent petroleum products[47] and transiting coastwise anywhere between Cook Inlet and San Diego should voluntarily stay a minimum distance of 50 nm offshore.

4. Vessels transiting short distances between adjacent ports should seek routing guidance as needed from the local Captain of the Port or VTS authority for that area.

5. In addition, the Workgroup recognizes that laden tank barges operated by members of the American Waterways Operators have agreed to a voluntary policy of transiting at least 25 miles offshore of the US West Coast. The Council of Marine Carriers in British Columbia has committed to a similar voluntary policy for its laden tank barges transiting in the open ocean off the West Coast of Canada, but also maintains the longstanding practice of tugs seeking refuge in the many inlets available along the BC coastline which may be the safer action under certain circumstances.

6. Nothing in these voluntary minimum distance offshore recommendations is intended to preclude a vessel master from taking prudent action for the safety of the vessel and its crew.

7. The Workgroup further recommends that these voluntary minimum distances offshore be communicated to mariners by placing the text of these recommendations in the Coast Pilot and Sailing Directions for the West Coast, and also by placing notes on the appropriate nautical charts, to be repeated at headlands, which indicate the voluntary minimum distances offshore and refer the mariner to the Coast Pilot and Sailing Directions for further details.

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[47] 33 CFR 154.1020, Definitions. Persistent oil means a petroleum-based oil that does not meet the distillation criteria for a non-persistent oil. For the purposes of this subpart, persistent oils are further classified based on specific gravity as follows:

(1) Group II - specific gravity less than .85.
(2) Group III - specific gravity between .85 and less than .95.
(3) Group IV - specific gravity .95 to and including 1.0.
(4) Group V - specific gravity greater than 1.0.

8. Regarding the areas where the Higher Risk zones go beyond 25 nm, the West Coast Offshore Vessel Traffic Risk Management Workgroup finds that various factors mitigate the risk in these areas. For instance, the coastal transportation trade along British Columbia and SE Alaska is primarily by tug and tows. A number of powerful potential "rescue tugs" are frequently transiting through these areas as a result of this unique trading pattern. These transiting tugs supplement the rescue tugs located in homeports as used in this study. In addition, many of these coastal trading tugs are powerful long distance tugs that report in to Canada's MCTS (VTS) and/or are equipped with transponders that enhance their identification as possible rescue tugs. For the area off Point Arguello, the Workgroup finds that the northbound lanes of the Traffic Separation Scheme to/from Los Angeles/Long Beach will capture this traffic.

V. <u>Findings and Recommendations regarding Data Improvements</u>

1. The West Coast Offshore Vessel Traffic Risk Management Project Workgroup finds that due to the configuration of the databases currently in use by US and Canadian federal agencies, information on cause and outcome of casualties is difficult to extract. We note that the US Coast Guard and the Canadian Transportation Safety Board are revising their vessel casualty databases, and recommend that they redesign these systems to allow for improved access to information on both the causes and outcomes of reported incidents. The Workgroup further recommends that the member agencies of the Pacific States/British Columbia Oil Spill Task Force implement their agreement to include causal information in their oil spill incident databases and to share that information on a coastwise basis.

2. The Workgroup also recommends that the US and Canadian Coast Guards work with the West Coast states and maritime industry to investigate the causes of past vessel incidents and casualties on the West Coast over a period of not less than five years. Particular focus should be given to casualties that might have led to a grounding (including propulsion losses, steering failures, tow wire failures, and navigational errors), collisions, and allisions. A final report should provide summary information on causes, trends, and possible prevention mechanisms.

3. The West Coast Offshore Vessel Traffic Risk Management Project Workgroup recommends that the US and Canadian Coast Guards continue to coordinate with marine exchanges and other appropriate organizations to improve coast-wise data collection procedures covering vessel movements in order to provide more detailed and standardized information regarding vessel types, cargo, routing, and ports of origin. Future implementation of AIS carriage should be evaluated as a potential source of data for this purpose.

VI. <u>Recommendation regarding Implementation Review</u>

1. The West Coast Offshore Vessel Traffic Risk Management Project Workgroup recommends that the Pacific States/BC Oil Spill Task Force work with the US and Canadian Coast Guards in 2007 to review the status of implementation and efficacy of the final recommendations from this project.

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