VESSEL TRAFFIC SERVICES:

Review of Technology, Training, and Protocols

May 2020

Prepared by:
Sharry Miller,
Nuka Research and Planning Group, LLC

For:
Prince William Sound
Regional Citizens' Advisory Council

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The opinions expressed in this PWSRCAC-commissioned report are not necessarily those of PWSRCAC.

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ACRONYMS AND ABBREVIATIONS

AIS	Automatic Identification System
CCG	Canadian Coast Guard
CCTV	Close-Captioned Television
CPA	Closest Points of Approach
EMSA	European Maritime Safety Agency
HELCOM	Helsinki Commission
IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities
IMO	International Maritime Organization
INNAV	Canada's Vessel Traffic Management Information System (identified by the acronym INNAV)
MAIB	Marine Accident Investigation Branch
MCTS	Marine Communications and Traffic Services
NCA	Norwegian Coastal Administration
NTSB	National Transportation Safety Board
OJT	On-the-Job Training
PQS	Performance Qualification Standard
PWS	Prince William Sound
PWSRCAC	Prince William Sound Regional Citizens' Advisory Council
STCW	International Convention on Standards of Training, Certification and Watchkeeping for Seafarers
SOLAS	International Convention for the Safety of Life at Sea
SOUNDREP	Sweden and Denmark's IMO-approved Mandatory Ship Reporting System in the Sound (Öresund)
STRAITREP	Singapore's IMO-adopted Mandatory Ship Reporting System
USCG	United States Coast Guard
VMRS	Vessel Movement Reporting System
VMT	Valdez Marine Terminal
VTIS	Vessel Traffic Information System
VTS	Vessel Traffic Service
VTSO	Vessel Traffic Service Operator

EXECUTIVE SUMMARY

In response to a 2016 National Transportation Safety Board (NTSB) report, "An Assessment of the Effectiveness of the US Coast Guard Vessel Traffic Service System," the Prince William Sound Regional Citizens' Advisory Council (PWSRCAC) contracted with Nuka Research and Planning Group, LLC (Nuka Research) to review the vessel traffic service (VTS) system in Prince William Sound (PWS). The goal of the review was to understand what constitutes best available technology in the field of VTS and how that technology, as well as practices and procedures, compare to those used in the PWS VTS system.

To conduct this assessment, Nuka Research reviewed the 2016 NTSB report, various international standards, the PWS Vessel Traffic Users' Manual, and other documents; researched VTS systems in the United States, Canada, Singapore, Norway, Sweden, and the United Kingdom; and interviewed the PWS VTS director and watch standers, and vessel captains using the PWS VTS. While VTS systems worldwide have the same goal of increasing vessel traffic safety and decreasing the possibility of vessel incidents, PWS was found to be unique in having a relatively low volume of vessel traffic using the system.

After reviewing the above materials, it appeared that the PWS VTS system is managed within the expectations of the U.S. Coast Guard (USCG), the governing authority for VTS systems nationwide. It might also be assumed that the USCG manages their system in accordance with international standards, but due to reasons of port security and federal Freedom of Information Act requirements it was not possible to get detailed information about many aspects of PWS VTS operations, including how U.S. standards may match those internationally.

One of PWSRCAC's goals for this project was to have an understanding of the best available technology in use worldwide for VTS systems. Unfortunately, it was not possible to obtain specific information about the hardware (radars, Automatic Identification System receivers, operations center displays, etc.) for any of the systems investigated, including the one in PWS.

Despite limitations on the ability to obtain some information, that which was collected resulted in several recommendations for the USCG with regards to PWS VTS operations:

1. Conduct repair and maintenance on the PWS radars and Close-Captioned Television cameras to bring them back into operation.
2. Ensure that PWS-specific on-the-job training is sufficient for watch standers and supervisors to understand PWS geography and vessel activity. At a minimum, the USCG should take advantage of opportunities for personnel to ride vessels (tour boats, tankers) to gain familiarity with the PWS region.
3. Develop a means for the USCG to automatically send notices and messages to fishermen or other interested parties on a timely basis.

4. During commercial fishing openers, particularly in Valdez Narrows, broadcast information about large vessel (tanker, cruise ship, etc.) transits on channel 16, which all vessels are required to monitor, rather than channel 13, which only VTS users are required to monitor, to help ensure everyone hears them.
5. Use radio repeaters that allow all vessels in PWS monitoring channel 13 to be able to hear information about vessel transits.

1.0 INTRODUCTION

In 2016, the National Transportation Safety Board (NTSB) published a report entitled "An Assessment of the Effectiveness of the US Coast Guard Vessel Traffic Service System" (NTSB, 2016). In the report, the NTSB made a variety of recommendations to the U.S. Coast Guard (USCG), the American Pilots' Association, the American Waterways Operators, and the Radio Technical Commission for Maritime Services. These recommendations were intended to improve vessel safety by reducing the risk of collisions, rammings, and groundings in areas with USCG Vessel Traffic Services (VTS).

The recommendations of the NTSB were not specific to the 12 individual VTS areas in the United States, but instead were implied to be applicable to all of the systems. Subsequent to the publication of the NTSB report, the Prince William Sound Regional Citizens' Advisory Council (PWSRCAC) became interested in understanding what constitutes best available technology in the field of vessel traffic services and how that technology, as well as practices and procedures, compare to those used in the Prince William Sound (PWS) VTS. The ultimate goal of the project was to compile a list of technologies and practices which could be recommended to the USCG as a way to improve the PWS VTS system. In order to gather this information, the PWS VTS director, VTS users, and other relevant individuals were interviewed; VTS system operators in other countries were contacted; and internet research was conducted.

This report provides a summary of VTS systems in the United States, international standards for VTS systems, a summary of the NTSB report, information on international VTS systems and marine incidents, a description of the PWS VTS and its users, and recommendations for the PWS VTS based on the research described.

2.0 VTS SYSTEMS IN THE UNITED STATES

2.1 VTS Purpose and History

According to the USCG, the purpose of a VTS "is to provide active monitoring and navigational advice for vessels in particularly confined and busy waterways." There are 12 VTS systems in the United States, the locations of which are shown in Figure 1. The goal of these VTS systems is to prevent "vessel collisions, rammings, and groundings in the harbor, harbor approach and inland waterway phase of navigation. They are also designed to expedite ship movements, increase transportation system efficiency, and improve all-weather operating capability" (USCG, 2020).

Although the first shore-side radar station monitoring ship movements in Europe was established in Liverpool in 1949, similar concepts in the United States were not explored until the late 1960s. At that time, a research and development effort began in San Francisco Bay called Harbor Advisory Radar, an advisory system in which involvement was voluntary. In 1971, the tankers *Arizona Standard* and *Oregon Standard* collided in dense fog just west of the Golden Gate Bridge and spilled approximately 800,000 barrels of bunker fuel into San Francisco Bay. The NTSB determined that several failures resulted in the collision, including that of the voluntary Harbor Advisory Radar (NTSB, 2016). Following this accident, a number of federal laws were enacted, including The Ports and Waterways Safety Act of 1972 (Title 33 USC §1221) which authorized the USCG to construct, maintain, and operate VTS systems. The USCG subsequently established 12 VTS locations around the United States, including one in Prince William Sound, Alaska. The act also authorized the USCG to require the carriage of electronic devices necessary for participating in the VTS system, a requirement currently met by the carriage of an Automatic Identification System (AIS) on board certain vessels.

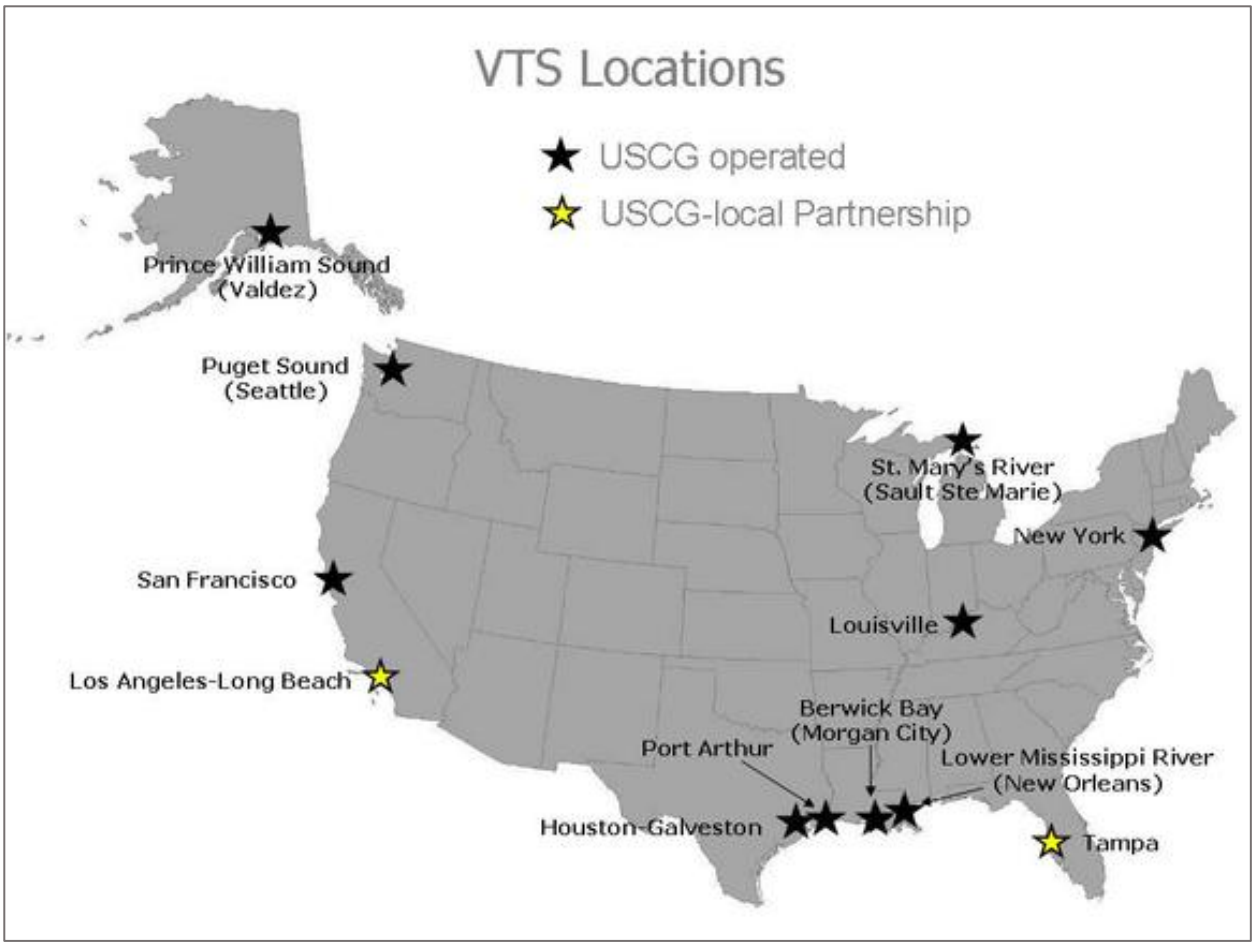

Figure 1. USCG VTS Locations (USCG, 2020)

In addition to VTS, another important component of the systems is the Vessel Movement Reporting System (VMRS), the mandatory reporting structure used to monitor and track vessel movements. It is under the VMRS that vessels are required to provide information on sailing plans and vessel locations per 33 CFR 161.16. For the purposes of this report, the term VTS will be assumed to also include VMRS unless there is a significant need to differentiate between the two.

2.2 VTS and VMRS Users

Not all vessels operating within the boundaries of a VTS are considered "users" of the system under federal regulation. Indeed, the regulatory requirements for a VMRS user and VTS user are different.

The following vessel types are categorized as VMRS users per 33 CFR 161.16:

- Every power-driven vessel of 40 meters (approximately 131 feet) or more in length, while navigating;

- Every towing vessel of 8 meters (approximately 26 feet) or more in length, while navigating; and
- Every vessel certificated to carry 50 or more passengers for hire, when engaged in trade.

VMRS users are required to fully participate in the VTS in accordance with 33 CFR 161 and make the following reports when applicable: Sailing Plan, Position Reports, and Final Report. VMRS users are also considered VTS users and must meet all requirements for VTS users outlined below.

VTS users include vessels that do not meet the criteria of a VMRS user but fall into one of the following categories (those subject to the Vessel Bridge-to-Bridge Radiotelephone Act [33 CFR 26]):

- Every power-driven vessel of 20 meters (approximately 65 feet) or over in length while navigating;
- Every vessel of 100 gross tons and upward and carrying one or more passengers for hire while navigating;
- Every towing vessel of 26 feet or over in length while navigating; and
- Every dredge and floating plant engaged in or near a channel or fairway in operations likely to restrict or affect navigation of other vessels except for an unmanned or intermittently manned floating plant under the control of a dredge.

VTS users that do not meet the VMRS user criteria are not required to submit the Sailing Plans, Position Reports, and Final Reports described in 33 CFR 161.19, 161.20, and 161.21. However, VTS users are required to maintain a listening watch on VHF channel 13 and comply with any measures issued by the VTS [33 CFR 161.12]. More information on the PWS VTS users can be found in Section 6.3.

2.3 VTS Authority to Direct Vessel Movements

Federal regulations under Title 33 CFR Part 161 not only describe which vessels must participate in a VTS system, but also what authority the VTS center has to establish measures and directions to enhance navigation safety within the VTS boundaries. Vessel reporting points and operational requirements (e.g., speed restrictions or specific traffic routes) are common measures. During conditions of vessel congestion, restricted visibility, adverse weather, or other hazardous circumstances, the VTS may control, supervise, or otherwise manage traffic, by specifying times of entry, movement, or departure to, from, or within the VTS area (USCG, 2017).

The USCG VTS program has in place general standards and guidance for personnel, operations, and equipment, many of which are described in the "Vessel Traffic Service National Standard Operating Procedures Manual." The manual also gives VTS directors the flexibility to interpret

how to implement the requirements to best serve the needs of their specific location (NTSB, 2016).

In practice, the USCG trains its watch standers to apply their authority by using four vessel traffic management activities (NTSB, 2016). From least to most assertive, these activities are:

1. *Monitor* by using resources to collect, organize, display, and analyze information about vessel traffic.
2. *Inform* relevant parties, including vessels, of information needed to facilitate vessel movements, safety, and security.
3. *Recommend* particular actions to vessel operators and others, usually to resolve miscommunications or call attention to particular circumstances, hazards, or conflicts when there is doubt that appropriate action is being taken.
4. *Direct* a course of action when necessary to minimize the risk of collision or damage to property or the environment or ensure compliance with navigation regulations. These directions are usually given in the form of desired outcomes; it is up to the vessel master to determine how that outcome will be achieved.

It is common practice for VTS watch standers, when they observe an issue that causes them concern, to call a vessel on the radio and ask, "What is your intention?" From this call the vessel operator is expected to understand that something may be amiss and respond that they are either maintaining their course of action or have realized that a change is needed and that they are making it. The watch stander may repeat the call or provide more information if it does not appear that the vessel operator understands the hazard. The vessel master is the final authority in ensuring vessel safety and choosing appropriate courses of action (February 4, 2020, interview with the PWS VTS director) (NTSB, 2016).

3.0 INTERNATIONAL STANDARDS

The International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) is a non-profit, international technical association that works toward world-wide improvement and harmonization of marine aids to navigation, including VTS systems, by convening international marine aids to navigation authorities, manufacturers, consultants, and scientific and training institutes to compare and exchange experiences and achievements. The United States is a member country of IALA and the USCG is a member organization.

The IALA publishes standards which are supported by recommendations and guidelines published as separate documents (see Appendix A of this report for a complete list of relevant IALA standards, recommendations, and guidelines). These recommendations and guidelines must be followed in order to claim compliance with the standard. According to IALA Standard S1040 Vessel Traffic Systems, included in the scope of the VTS standard are VTS implementation, operations, data and information management, communications, technologies, auditing and assessing, and additional services (IALA, May 2018).

Other international maritime standards are developed by the International Maritime Organization (IMO) and International Convention for the Safety of Life at Sea (SOLAS). Under SOLAS regulations, VTS systems are to follow the guidelines adopted by the IMO. In 1985, the IMO adopted resolution A.578 (14) Guidelines for Vessel Traffic Services and said that "VTS was particularly appropriate in the approaches and access channels of a port and in areas having high traffic density, movements of noxious or dangerous cargoes, navigational difficulties, narrow channels, or environmental sensitivity. The guidelines also made clear that decisions concerning effective navigation and maneuvering of the vessel remained with the ship's master. The guidelines highlighted the importance of pilotage in a VTS and reporting procedures for ships passing through an area where a VTS operates" (IMO, 2020).

In 1997, the IMO adopted revised VTS guidelines which included Guidelines on Recruitment, Qualifications, and Training of VTS Operators. The IMO resolution specifically states that the guidelines should be used in conjunction with the IALA VTS Manual (IMO, 1997). Indeed, IALA has taken the requirements of the IMO and SOLAS and adopted them into the specific standards, guidelines, and recommendations which have been accepted by the international maritime community, including the IMO and SOLAS for VTS systems.

In general, the IALA standards, guidelines, and recommendations are not prescriptive and do not stipulate specific criteria which must be met (e.g., the number of watch standers on shift at any one time or the particular content of training programs), but instead specify the areas which must be considered by those establishing, managing, and evaluating VTS systems. The IALA standards, guidelines, and recommendations are designed to aid the VTS authorities in ensuring that a system is designed and managed to accomplish the mission of the system by

guiding the designers' assessment of factors such as operator training, information displays, communication with vessels, and much more.

4.0 NTSB VTS Study Report

The 2016 NTSB report entitled "An Assessment of the Effectiveness of the US Coast Guard Vessel Traffic Service System" stated that the goal of the study was "to evaluate the effectiveness of the Coast Guard VTS system by assessing its ability to (1) detect and recognize traffic conflicts and other unsafe situations, (2) provide mariners with timely warning of such traffic conflicts and unsafe situations, and (3) control vessel traffic movements in the interest of safety" (NTSB, 2016). The study examined all 12 of the USCG VTS systems and provided recommendations based on the systems as a whole.

According to the report, "[t]he NTSB used a combination of quantitative and qualitative data sources and associated analytical methods to assess the effectiveness of the VTS system. The NTSB analyzed accident and vessel movement statistics and waterborne freight movement data for each VTS area, and used a questionnaire, site visits, and interviews to characterize the workforce and operations within the 12 VTS centers. In addition, industry associations, safety committees, and local waterway stakeholders provided comments and feedback on their experiences as users of the system. Finally, the NTSB conducted a comprehensive review of Coast Guard VTS statutory and regulatory requirements; national and local operating procedures; and personnel training, certification, and qualification standards; and it also collected similar information regarding vessel traffic management systems in Canada and Europe" (NTSB, 2016).

The NTSB determined that the USCG does not have a standard method for measuring the collective safety performance of all 12 VTS centers as a VTS system, and that VTS directors independently decide how to apply the USCG's general requirements and guidance in key areas involving personnel, operations, and equipment. "There were inconsistencies in the collection and use of traffic, incident, and near miss event data by the centers, and few best practices or minimum standards of effectiveness that were being shared and consistently applied across the Coast Guard VTS system" (NTSB, 2016).

After reviewing a variety of quantitative and qualitative data, the NTSB identified four areas of safety concern:

1. Variation in the use of USCG VTS authority,
2. Inadequate VTS watch stander training and qualification,
3. VTS system limitations,
4. Insufficient safety risk management of VTS areas.

The study concluded with a variety of recommendations to the USCG, the American Pilots' Association, the American Waterways Operators, and the Radio Technical Commission for Maritime Services.

Applicability of the NTSB's safety concerns and recommendations to the PWS VTS will be addressed in Sections 7 – 10 of this report. The performance of and recommendations to the American Pilots' Association, the American Waterways Operators, and the Radio Technical Commission in PWS are beyond the scope of this project.

5.0 INTERNATIONAL VTS SYSTEMS

As part of this project, PWSRCAC was interested in understanding how the PWS VTS system compared to others in the world with similar geography or vessel traffic. Most countries with busy commercial ports have VTS systems in place to manage traffic flow and safety. According to the IALA website, it had 87 member countries in 2019, and membership has consistently increased over the past 20 years. For comparative purposes, information was sought on the VTS systems in Canada, Norway, Sweden, Scotland (Sullom Voe), and Singapore.

The following questions and a brief overview of this project were sent to each country's VTS program:

1. How many watch standers or VTS operators are on shift at any one time, how long are their shifts, and what is their shift rotation like (for example, how many shifts per week)?
2. What previous experience are watch standers expected to have? What training do they get (formal, on-the-job training, performance checklists)?
3. What is the volume of traffic through the VTS?
4. What displays are used in the VTS center? What information is displayed and how much control do the watch standers have over the information displayed (for example, can they zoom in on particular areas or change the type of information they receive about a specific location)?
5. Are radars used to track vessel traffic, especially for those vessels not required to have AIS? If so, what information is available about the radar systems?
6. Other than radio communications, are there other methods of communication with vessels?
7. What kind of information or direction do watch standers/operators give vessels? Will they give them specific directions, or do they just ensure captains are aware of potential problems?

Enquiries sent to these countries resulted in responses from Canada, Singapore, and Norway. Limited information was available from websites on the VTS systems in each country. Additionally, an internet search was conducted for each country to locate marine incident reports in English for incidents during the last 10 years in which the local VTS system was involved in any way to determine if there were lessons learned from the incidents. Germane reports were located for Canada, Sweden, and the United Kingdom. Pertinent available and supplied information on both the systems and incidents is summarized in the sections below.

5.1 Canada

Information on the Canadian VTS system, known as the Marine Communications and Traffic Services (MCTS) system, was obtained from two sources, the Canadian Coast Guard (CCG) website[1] (general information about the MCTS system) and a March 18, 2020, email from Robert Crooks, Superintendent, MCTS – Western. Mr. Crooks responded to questions about the Canadian VTS system in general, but was also asked to focus on the Prince Rupert system if it was more straightforward to answer questions with regards to a specific location. Prince Rupert was suggested because it is on the west coast of Canada and in an area geographically similar to PWS, although the number of vessel transits in the Prince Rupert MCTS is on the order of seven to eight times greater than in PWS. Information that is specific to Prince Rupert will be noted below. Mr. Crooks also provided information on operator training, work schedules, and duties.

The CCG has divided the Canadian coastline into three regions. The Atlantic region has seven MCTS zones, the Central and Arctic region has one zone, and the Western region has three zones.

The MCTS on the west coast of British Columbia is different than the VTS system in PWS because on that coast MCTS applies to all navigable waters along the coast rather than just having the harbor-and-approaches method used in PWS. Additionally, there is a shared effort between Canada and the U.S. that is described in the "Cooperative Vessel Traffic Services Agreement." Victoria Traffic and Prince Rupert Traffic provide vessel traffic services as part of this agreement. Their service area includes Canadian and U.S. waters of Haro Strait, Boundary Passage, lower Georgia Straits, the offshore approaches to the Juan de Fuca Strait, and the Washington state coastline from 48 degrees north. Seattle Traffic, the USCG Puget Sound VTS in Seattle, Washington, provides services for both the Canadian and U.S. waters of the Juan de Fuca Strait.

The MCTS in Prince Rupert typically has five officers on watch each shift, four in operational positions and one as the shift supervisor. The officers provide both VTS and maritime emergency and safety communications and rotate between those duties throughout a working shift. At any one time, two officers are focused on safety and two on VTS, and they are split between the North and South Prince Rupert areas.

Officers in the MCTS work 12-hour shifts beginning at either 07:30 or 19:30 local time. They work a nine-day work week with a shift rotation that includes two day shifts, two night shifts, and five off-duty days, with 24 hours off between the end of the officer's second day shift and the start of the first night shift.

There are minimal requirements for MCTS officer applicants, although previous maritime experience is beneficial. Working within the MCTS is considered a professional trade within the

[1] https://www.ccg-gcc.gc.ca/mcts-sctm/vessel-traffic-trafic-maritime-eng.html#Regional

Canadian government; individuals with necessary aptitudes are selected and given appropriate training. Once hired, officer trainees are given 6 months of training at the CCG College in Sydney, Nova Scotia, where they receive a combination of classroom and simulator training, followed by a rigorous series of simulation evaluations to verify that they have met the college graduation criteria. The average success rate for students through the CCG College MCTS program is 80 percent.

After completion of the college program, graduates are sent to their first posting in the CCG Western Region, either MCTS Victoria or MCTS Prince Rupert. Once there, they receive approximately one month of classroom instruction concerning geography of the Area of Responsibility and local knowledge (i.e., communities, pivotal First Nation areas, location of Search and Rescue resources, fishing types and area, etc.). Afterward, the trainee is assigned to an On-the-Job Instructor to work with for up to five months. At the end of this period the trainee undergoes a Centre Designated Checkout to assess their competence and capabilities. If they are successful, they become certified officers at that center; if unsuccessful, a review board convenes to determine if there is any chance of successful certification and, if so, to develop a training plan. If the board determines there is no reasonable hope of success, then the trainee is released from the program. Officers are only certified to work at their center. If they transfer to another center, they have to undergo the classroom and on-the-job training (OJT) to receive certification for the new facility. If they are unsuccessful in completing the new training, they are returned to their previous center.

Requirements for which vessels must participate in the MCTS system are similar to those in the U.S., as are the communications the vessels are required to make. The MCTS officers use VHF radios to communicate with vessels, and use AIS as well as surveillance radar in areas of high traffic density to track vessel movements. The MCTS officers have full control over the remote radars, the extractors that bring information from the remote sites to the MCTS center, and the information display. They can draw zones and set alarms, they can compare transits against each other and calculate Closest Points of Approach (CPA) and Time to CPA, and have many other tools that aid in the management of vessel traffic.

Another important communication tool is the Vessel Traffic Management Information System (identified by the acronym INNAV). The INNAV website is one way pertinent information on marine traffic is provided to MCTS clients and partners. INNAV is a system used mainly by MCTS operational centers. Those centers are located all across Canada and cover all navigable waterways. The main kinds of information available on this site include:

- Marine traffic currently active in Canada, including regulated vessels located in zones that can be extended up to 24 hours before their entry into Canadian waters;
- Vessels' current position, origin, destination, estimated arrival time, passage times at specific points, source position, etc.;
- Vessels' characteristics;

- Detailed itineraries;
- Detailed movement reports;
- Arrival/departure histories;
- Traffic histories;
- Transit forecasts at pilot boarding points;
- Traffic forecasts;
- Vessel positions on marine chart, satellite, and relief backgrounds (including speed, source position, etc.);
- Search for places near or on navigable waterways;
- Traffic statistics; and
- Various reference documents.

Subscriptions are available to the INNAV service with varying levels of information access depending on authorizations.

With regard to their authority, MCTS officers, in the course of their duties, give waterway information, recommendations, and directions. Directions are rare, but when they occur MCTS officers are only permitted under the Canada Shipping Act, 2001, Section 126(3) to:

a) Grant a clearance to a vessel to enter, leave, or proceed within a MCTS zone;

b) Direct the master, pilot, or person in charge of the deck watch of the vessel to provide, in the manner and at any time specified in the direction, any pertinent information in respect of the vessel that may be specified in the direction;

c) Direct the vessel to use any radio frequencies in communications with coast stations or any other vessel that may be specified in the direction; and

d) Direct the vessel, at the time, between the times, or before or after any event that may be specified in the direction,

   i. To leave the MCTS zone,

   ii. To leave or refrain from entering any area within the MCTS zone that may be specified in the direction, or

   iii. To proceed to or remain at any location within the MCTS zone that may be specified in the direction.

At no time can any direction given by a MCTS officer be such that it infers or specifies taking command of the vessel.

5.2 Singapore

Information on the Singapore Vessel Traffic Information System (VTIS) was obtained from two sources, the VTIS webpage for the Maritime and Port Authority of Singapore[2] (general information about the VTIS system) and in an email received on April 5, 2020, from Captain Henry SNG, Senior Marine Officer (Vessel Traffic Management), Maritime and Port Authority of Singapore. Captain SNG responded to emailed questions about the Singapore VTIS and provided information about operator training, work schedules, and duties. The VTIS system in Singapore was chosen for review at the request of PWSRCAC.

Approximately 130,000 vessels call on Singapore's two VTIS centers annually; about 2,500 are in the system at any one time. Ships of the following categories are required to participate in the IMO-adopted Mandatory Ship Reporting System known as STRAITREP:

- vessels of 300 GT and above;
- vessels of 50 meters (approximately 164 feet) or more in length;
- vessels engaged in towing or pushing with a combined gross tonnage of 300 and above, or with a combined length of 50 meters or more;
- vessels of any tonnage carrying hazardous cargo;
- all passenger vessels that are fitted with VHF, regardless of length or tonnage; and
- any category of vessels fitted with VHF that uses the appropriate traffic lane or separation zone in an emergency situation to avoid immediate danger.

The ships are required to report under STRAITREP to Singapore's VTIS. The report required from a ship contains only information that is essential to meet the objectives of the STRAITREP, including ship name and registration, position, hazardous cargo, ship course and speed, and any damage to the ship that would affect its normal navigation.

In turn, STRAITREP provides information to ships about specific and critical situations that could cause conflicting traffic movements and other information concerning safety of navigation. STRAITREP also uses VHF radio channels to broadcast information of general interest to ships.

The two VTIS centers provide constant coverage of the waters of Singapore Straits and within port limits. Twenty-four personnel are on duty in the two centers at all times, including watch managers, supervisors, and operators. There are three shifts of personnel per day, and generally the shifts change once every three days with at least one day off between sets of working days.

All staff receive training compliant with IALA standards and are certified before they are deployed in VTIS operations. Watch managers are qualified Master Mariners and are required

[2] https://www.mpa.gov.sg/web/portal/home/port-of-singapore/operations/vessel-traffic-information-system-vtis

to complete a three-month induction program before they are allowed to keep watch independently. Operators are required to complete two weeks of theory classes and 2.5 months of practical OJT.

The VTIS centers use AIS, as well as X-band and S-band radars, to track vessel movements. The operators have work stations which overlay the AIS and radar information, and are able to customize the displays to the user's individual preference, including being able to zoom in on areas of interest or select particular chart display orientations. Personnel can communicate with ships via AIS and VHF radio. They are trained to provide information and advice that is result-oriented, leaving decisions of execution to the ship master.

5.3 European VTS Systems

The European Maritime Safety Agency (EMSA)[3] coordinates marine safety efforts of member countries through SafeSeaNet, a vessel traffic monitoring and information system established to enhance maritime safety, port and maritime security, marine environment protection, and efficiency of maritime traffic and maritime transport. It was set up as a network for maritime data exchange, linking together maritime authorities from across Europe. SafeSeaNet enables European Union member states, Norway, and Iceland to provide and receive information on ships, ship movements, and hazardous cargoes. The main elements that are contained in the system and made available to users include:

- AIS-based near-real-time ship positions (i.e., one every 6 minutes),
- Archived historical ship positions (over several years),
- Additional information from AIS-based ship reports (e.g., identification name/numbers, flag, dimensions, course, speed, dimensions, destination, and ship type),
- Estimated/actual times of arrival/departure,
- Details of hazardous goods carried on board,
- Information on safety-related incidents affecting ships,
- Information on pollution-related incidents affecting ships,
- Details of waste carried on board and/or to be offloaded (after June 2015),
- Ship security-related information (after June 2015),
- Information on the location of remaining single-hulled tankers,
- Information on the location of ships that have been banned from EU ports, and
- Digital map layers (containing information on depths, navigation aids, traffic separation schemes, anchorages, AIS station locations, etc.).

[3] http://www.emsa.europa.eu/ssn-main.html

The countries whose VTS systems are described below are all members of SafeSeaNet. These locations were selected for review because of their geographic similarities (numerous fjords and islands, restricted waterways) to Prince William Sound.

5.3.1 Norway

Information on the Norwegian VTS system was obtained from the Norwegian Coastal Administration (NCA) website[4] and in an April 21, 2020, email from Mr. Trond Ski of the NCA's Department of Maritime Safety.

In Norway, five VTS centers, four in the south and one in the north, monitor and regulate ship traffic in regulated geographic areas along the Norwegian coast. The centers were primarily established in connection with the petroleum industry to allow coverage into busy oil and gas terminals. In 2019, the busiest VTS saw 17,153 vessel transits, and the least busy VTS had 8,035 transits.

Established radar sensors, video cameras, meteorological sensors, the NCA's AIS chain, and the SafeSeaNet Norway ship reporting system for ship traffic are important support tools for the traffic control centers in this area. No location has full radar coverage and only the narrowest waterways use cameras to monitor vessels without AIS transmitters.

Three types of services are offered based on national regulations and international recommendation.

1. **Navigation Information Service**

   This service provides important information when needed to support nautical decision-making processes on board. A vessel can request information, and the VTS center can provide unsolicited information and ask the vessel questions if something is unclear. Information can include:
   - Information on the traffic situation, such as position, identity of the vessel, destination,
   - Meteorological and hydrographic information,
   - Relevant limitations or activities in the fairways,
   - Guidelines for mandatory reporting, and
   - VHF channels that are used in the VTS area.

2. **Navigation Assistance Service**

   Navigation assistance is established either on request from a vessel or when the VTS operator observes irregular navigation and the VTS operator deems it necessary to intervene. The vessel and VTS center will agree on when the navigation assistance service starts and stops. This service entails assistance that is linked closely to the vessel in question. Examples of navigation assistance situations include:

[4] Information on the Norwegian VTS system is from the website https://kystverket.no/en/EN_Maritime-Services/Vessel-Traffic-Service/

- Difficult meteorological conditions,
- Faulty or defective equipment on board,
- Vessels that deviate from a sailing plan,
- Assistance en route to an anchorage site or pilot embarkation buoy/area,
- Risk of running aground or collision, and
- Vessel that is uncertain of its position, or not able to determine its position.

The VTS center can provide:

- Bearing and distance to nearby hazards or landmarks,
- Recommendations on a course to the next waypoint,
- Position in relation to the fairway axis, navigation functions, and/or waypoints, and
- Support and information on the current traffic situation to the crew on the bridge.

3. **Traffic Organization Service**

   The purpose of this service is to prevent hazardous situations from developing and to ensure safe and efficient navigation through the VTS area. The VTS center provides information, advice, and instructions to vessels. Vessels report before sailing into the VTS area or when leaving an anchorage site or dock in order to avoid traffic congestion that can create critical situations. For example, the Maritime Traffic Regulations regulate meeting and passing bans and granting a vessel clearance to sail into a VTS area. Clearance can be granted without conditions, but special conditions can also be stipulated through the use of special fairways or sailing in a specific order in relation to other traffic. Clearance can be withheld when there is a valid reason for doing so.

The VTS centers are staffed by VTS operators (VTSO), with two on-shift at all times. The number of operators assigned to a center and their shift rotations vary by center, particularly because some of the centers are very remote and are staffed by personnel who travel there for work but do not live in the area.

In order to be a VTSO, a candidate must have the education required to gain the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW) deck officer class one certificate and must have acquired sufficient experience at sea to hold a STCW deck officer class two certificate. Once accepted for training, a recruit must pass an IALA-based training course that includes classroom and simulator training. The certification earned must be renewed every five years by passing a revalidation course.

In addition to classroom training, VTSOs must complete eight weeks of OJT at their assigned VTS center to gain the authorization to perform watch duty at that specific center. This authorization is valid for one year at the time, requiring VTSOs to go through a revalidation process at the center every year which includes a review of the VTS area and local regulations and a written test. Finally, VTSOs go through a Crew Resource Management course every third

year, focusing on simulator sessions. In total, a VTSO will, on average, receive training at a simulator center every second year.

Each VTS center has two VTSO workstations. Between the two stations is one 75-inch monitor with a map that covers the whole VTS area. At each VTSO position there are three 55-inch monitors on top, three 32-inch monitors at the bottom, and two 24-inch monitors enclosed in the desk area. The large monitors on top show map overviews of the VTSO's sector along with camera pictures. The three smaller screens below are zoomed in on specific hot-spot areas like narrow waters or areas with crossing traffic. The two smallest screens at the desk are touch screen and used to operate communication equipment (VHF radios and satellite phones) and an operator support system which gives useful information and data support. VTSOs can change their monitor layout and zoom in on different areas as needed. In addition, they can make small changes regarding where the various types of information are displayed. In general, there is a standard setup that every VTSO uses. There are only minor personalized differences between workstation setups.

5.3.2 Sweden[5]

Sweden has nine VTS centers along its coastline with vessel participation and reporting requirements similar to those of other countries and in accordance with IALA and IMO standards. Additionally, in joint cooperation, Sweden and Denmark established an IMO-approved Mandatory Ship Reporting System in the Sound (Öresund) named SOUNDREP with the purpose of improving the safety of navigation and the protection of the marine environment in the Sound area. SOUNDREP provides information to ships about specific and urgent situations, which may cause conflicting traffic movements, as well as other information concerning safety of navigation. It can also provide individual information to a ship, particularly in relation to positioning and navigational assistance or local conditions. SOUNDREP is operated by Sound VTS from a joint center in Malmoe, Sweden.

Sweden (along with Denmark, Estonia, the European Union, Finland, Germany, Latvia, Poland, and Russia) is a member of the Baltic Marine Environment Protection Commission, also known as the Helsinki Commission (HELCOM), an intergovernmental organization and a regional sea convention in the Baltic Sea region. HELCOM is the governing body of the "Convention on the Protection of the Marine Environment of the Baltic Sea Area," also known as the Helsinki Convention. A platform for environmental policy making at the regional level, HELCOM was established about four decades ago to protect the marine environment of the Baltic Sea from all sources of pollution through intergovernmental cooperation (HELCOM, 2020).

AIS data from all countries in the Baltic region is collected, aggregated, and redistributed for surveillance purposes to different organizations in the HELCOM countries. The data is also

[5] Information on Sweden's VTS system is from the website http://www.sjofartsverket.se/en/Maritime-services/Maritime-Traffic-Information/

stored centrally to facilitate production of reliable statistics of the ship traffic in the Baltic. AIS data is also exchanged with other EU member states, via the "SafeSeaNet" system.

5.3.3 Scotland (Sullom Voe)[6]

The port of Sullom Voe is a major deep-water harbor owned and operated by Shetland Islands Council as the harbor authority. Sullom Voe accepts vessels 140 – 365 meters length overall as a matter of routine and vessels outside of this range on an individually-approved basis.

The Sullom Voe VTS is manned on a continuous basis by VTS operators qualified to the standards in IALA Recommendation 103-1. The operators offer Traffic Organization Services to prevent the development of dangerous maritime traffic situations and to provide for the safe and efficient movement of vessel traffic within the VTS area and Information Services to ensure that essential information becomes available in time for on-board navigational decision making.

The operators monitor a variety of VHF channels designated for specific communications (e.g., tanker pilotage, fires, distress) as well as offering brief local weather forecasts and traffic information on request. Additionally, operators maintain a continuous radar and AIS watch and the passage of each vessel is monitored and recorded. Advice is available to vessels on request.

5.4 Vessel Incidents in VTS Systems

One aspect of VTS systems examined in the 2016 NTSB report was vessel incidents in U.S. waters and the impact of the local VTS centers on those incidents. For this report, an internet search was conducted to find marine vessel incident reports in English within the past 10 years from various locations globally to see what impact VTS systems had on the incidents. Reports meeting those criteria were located for Canada, Sweden, and the United Kingdom.

5.4.1 Canada

A variety of incident reports are available through the Transportation Safety Board of Canada Marine Transportation Safety Investigations and Reports webpage. Not all involve vessels participating in an MCTS zone. Three recent incidents and the involvement of the MCTS in them are summarized below. These are not necessarily all such incidents that occurred in the past 10 years.

- On August 27, 2010, the passenger vessel *Clipper Adventurer* ran aground on a charted shoal in Coronation Gulf, Nunavut, while on a 14–day Arctic cruise. On August 29, all 128 passengers were transferred to the CCGS *Amundsen* and taken to Kugluktuk, Nunavut. The *Clipper Adventurer* was refloated on September 14, 2010, and escorted to Port Epworth, Nunavut. The MCTS determined that there was minor pollution and no injuries. The vessel was in an area required to participate in the *Northern Canada Vessel*

[6] Information on the Sullum Voe VTS system is from the website https://www.shetland.gov.uk/ports/sullomvoe/vts/

Traffic Services Zone. In accordance with MCTS practices, the MCTS center does not automatically issue written Notices to Shipping (the Canadian term for notices to warn mariners about local navigation hazards) to ships once they have submitted their intended route plan. However, the notices are readily available through a variety of means to which the ship's master had access. There was an available notice regarding the location of the shoal on which the ship went aground.[7]

- On September 5, 2015, the fishing vessel *Caledonian* capsized 20 nautical miles west of Nootka Sound, British Columbia. At the time, the vessel was trawling for hake with four crew members on board. Following the capsizing, the master and mate climbed onto the overturned hull and remained there for several hours. When the vessel eventually sank, the master and mate abandoned it, and the mate swam toward and boarded the life raft. The CCG subsequently rescued the mate and recovered the bodies of the master and the two other crew members. The *Caledonian's* master reported to the local MCTS when he was leaving the MCTS zone to begin fishing and was told to check back in when he was on his way to port. The MCTS last received an AIS signal from the vessel at about the time is was assumed to have sunk and was unable to establish communication with it. Apparently, poor radio reception in the area of the vessel was not unusual. The MCTS was not found at fault in the investigation as the fishing vessel was outside of the MCTS zone when it capsized.[8]
- On March 2, 2016, the tug *H.M. Scout* departed Victoria, British Columbia, en route to Bamberton, British Columbia, with the barges *HM Tacoma* and *HM Blue Horizon* in tandem tow. During the passage, the tug encountered severe weather, the tow line between the barges parted, and the *HM Blue Horizon* grounded near Clover Point, British Columbia. During the recovery attempt, a piece of the parted tow line fouled the tug's propeller, partially disabling the tug. The *HM Tacoma* subsequently grounded near Finlayson Point, British Columbia, and the disabled tug released the tow line and returned to Victoria. There were no injuries, but some of the scrap construction material from the *HM Blue Horizon* was lost overboard. While the tug master did report his departure from Victoria and his intended route to the MCTS, he did not update his position at further reporting points or notify the MCTS that he had 2,000 liters of fuel on the barge for a deck crane. After the barge was lost, it took more than 45 minutes for the master to notify MCTS that there was a problem (a notification that should have happened immediately) and did not respond to repeated attempts by the MCTS to contact him.[9]

[7] https://www.bst-tsb.gc.ca/eng/rapports-reports/marine/2010/m10h0006/m10h0006.html
[8] https://www.bst-tsb.gc.ca/eng/rapports-reports/marine/2015/m15p0286/m15p0286.html
[9] https://www.bst-tsb.gc.ca/eng/rapports-reports/marine/2016/M16P0062/M16P0062.html

5.4.2 Sweden

The Swedish Accident Investigation Authority (Statens haverikommission) is a national authority with the task of investigating accidents and incidents with the aim of improving safety. The incident summary below is from an official incident report.

- On October 15, 2014, en route from Liepaja – Hässelby via Landsort/Södertälje, the Latvian vessel *Liva Greta* collided with dolphins just before passing Nockeby Bridge. A construction worker fell into the water at the time of the accident but was not injured. No damage was caused to the actual bridge structure. The master, who didn't know about the construction work in the channel below the bridge, came rather fast and made a fairly ample speed reduction, followed by reversing engine, which led to loss of steering. The vessel veered and subsequently turned into and damaged two dolphins. The vessel then continued to its berth in Hässelby, where damage to the bow was discovered above the water line. At the time of the accident, work was in progress on replacing the fendering between the dolphins. There was no pilot on board the vessel at any time during the just over 6.5 hour-long journey within the Stockholm Archipelago before the incident, and the vessel was not subject to compulsory pilotage. VTS did not inform the vessel of the repair work that was in progress on Nockeby Bridge. An announcement had been inserted in the Swedish Notices to Mariners concerning ongoing bridge repairs and an indication that caution should be observed when negotiating the bridge. [10]

5.4.3 United Kingdom

The Marine Accident Investigation Branch (MAIB) within the United Kingdom (U.K.) Department of Transport investigates marine accidents involving U.K. vessels worldwide and all vessels in U.K. territorial waters. The following marine vessel synopses are from MAIB Incident Reports.

- On February 11, 2015, the U.K.-registered container ship *Ever Smart* collided with the Marshall Islands-registered oil tanker *Alexandra 1* near the entrance to the buoyed approach channel in Jebel Ali, United Arab Emirates. The container ship was outbound at a speed of 12 knots and had disembarked its pilot. The tanker was inbound and was moving very slowly ahead while waiting for the pilot from the container ship to board. Both vessels suffered major structural damage to their bows but there were no injuries or pollution. The collision resulted from several factors. In particular, a passing arrangement was not agreed or promulgated, and the actions of both masters were based on assumptions. *Alexandra 1* was unnecessarily close to the channel entrance and the tanker's master acted on scanty VHF radio information. In addition, *Ever Smart*'s bridge team did not keep a proper lookout or monitor the tanker's movement. They

[10] https://www.havkom.se/assets/reports/English/RS-2014_01e.pdf

only realized that *Alexandra 1* was close ahead seconds before the collision when alerted by the port control. The accident occurred within Jebel Ali's port limits. The precautions of pilotage and the port's VTS system, which would normally co-ordinate and de-conflict the movements of vessels in the port area, were found to be ineffective on this occasion. [11]

- On October 8, 2017, the Barbados-registered general cargo ship *Islay Trader* grounded off Margate, Kent, U.K. The vessel re-floated approximately 12 hours later and anchored nearby. The vessel sustained indentations to its bow and bent frames, but there were no injuries and no pollution. The chief officer did not monitor the vessel's position and was not aware that the vessel had dragged its anchor until alerted by the London VTS. Interventions by the London VTS that were intended to stop the vessel from grounding were found to be timely and appropriate. [12]

[11] https://www.gov.uk/maib-reports/collision-between-container-vessel-ever-smart-a nd-oil-tanker-alexandra-1
[12] https://assets.publishing.service.gov.uk/media/5af16f7d40f0b652c101be51/MAIB InvReport09-2018.pdf

6.0 PWS VTS

6.1 Location and Components

The PWS VTS based in Valdez, Alaska, allows the USCG to monitor crude oil tankers and other select vessels transiting through PWS. This VTS system is required by The Trans-Alaska Pipeline Authorization Act (Public Law 93-153), enacted in 1973, and extends north of a line drawn from Cape Hinchinbrook Light to Schooner Rock Light (between 146°30'W and 147°20'W) and includes Valdez Arm, Valdez Narrows, and Port Valdez (see Figure 2).

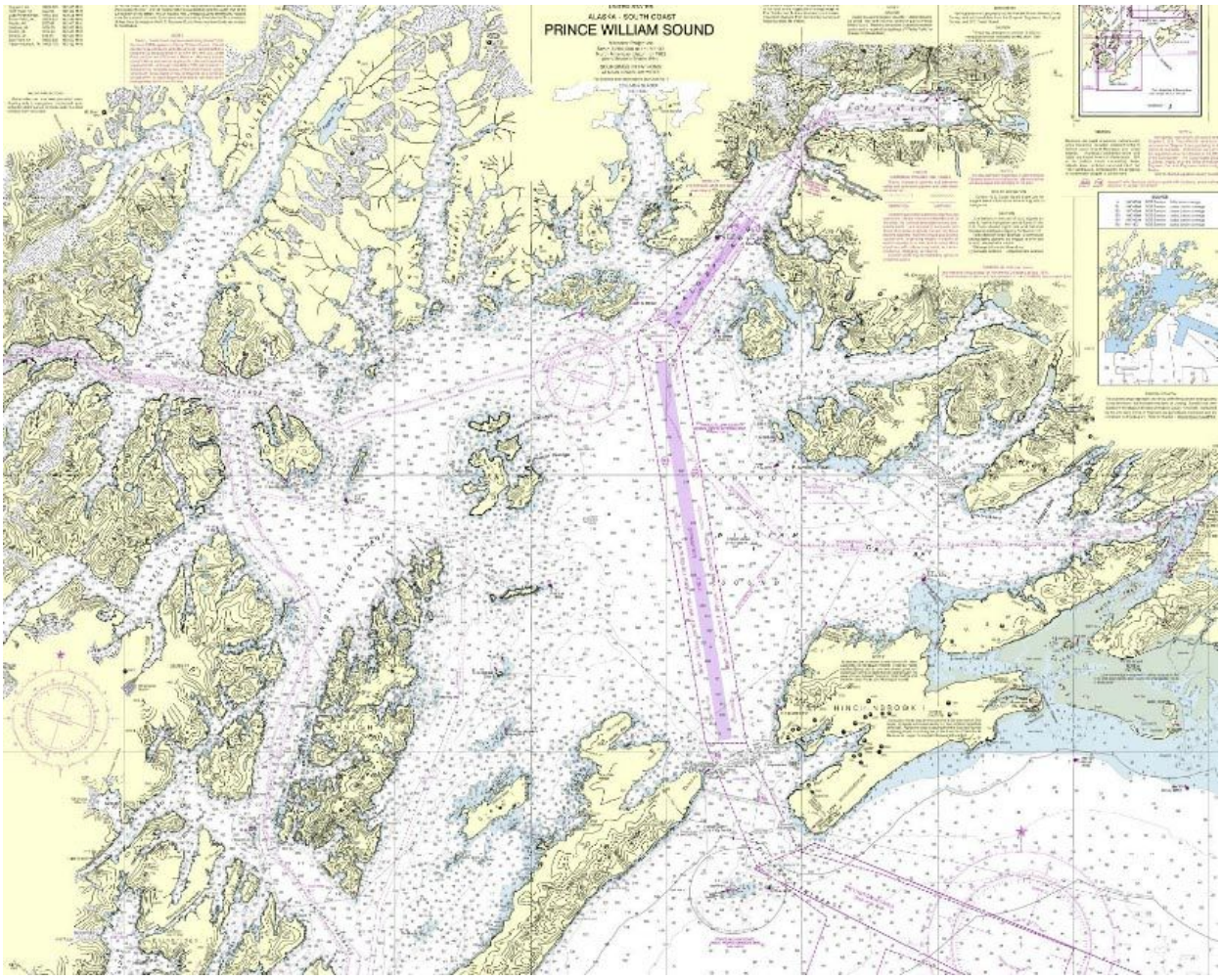

Figure 2. Prince William Sound Vessel Traffic System Chart (USCG, 2017)

The PWS VTS is a surveilled system[13] that consists of several land-based sensors that output their signals to the Valdez Traffic Center at the USCG offices in Valdez where the data is integrated into two sets of displays for monitoring by two-to-three military and civilian watch standers continuously. The USCG considers this system to consist of nine components:

- Vessel Traffic Center in Valdez,
- Code of Federal Regulations which includes the VTS regulatory authority,
- Radar Surveillance System,
- Universal AIS,
- VHF-FM Communications System,
- Closed-Caption Television (CCTV) Surveillance System,
- Regulated Navigation Area,
- Traffic Separation Scheme, and
- Emergency anchorage site at Knowles Head.

These components are used by the watch standers to monitor and, if necessary, advise vessels to help ensure safe transits through PWS.

Within the VTS system are VTS Special Areas where special operating requirements apply. Two VTS Special Areas exist in PWS: the Valdez Narrows VTS Special Area and Valdez Arm VTS Special Area. VTS users have particular reporting and towing requirements in these areas.

Additionally, there are five Safety Zones in PWS, entry into which is forbidden without permission of the USCG Captain of the Port or District Commander. These Safety Zones are at (1) the Valdez Marine Terminal (VMT), (2) around tank vessels arriving at or departing the VMT, (3) Ammunition Island (locally known as the Valdez Container Terminal), (4) around vessels transiting to or from Ammunition Island, and (5) the Alaska Marine Highway System Port Valdez Ferry Terminal when a ferry is transiting in the vicinity of the terminal and there is a commercial fisheries opener in Port Valdez.

Finally, there are four security zones in PWS, entry into which is forbidden without permission of the Captain of the Port. While in a security zone, a person must obey all orders of the Captain of the Port or risk removal from the zone. The security zones are (1) around the VMT; (2) all waters within 200 yards of any Trans Alaska Pipeline System tank vessel maneuvering to approach, moor, unmoor, or depart the VMT or transiting, maneuvering, laying to, or anchored within the boundaries of the Captain of the Port, Prince William Sound Zone; (3) all waters 200 yards either side of the Valdez Narrows Tanker Optimum Track line when a tanker is present in

[13] A non-surveilled VTS system consists of one or more reporting points at which ships are required to report their identity, course, speed, and other data to the monitoring authority, but do not necessarily have equipment installed to surveil them.

the Narrows; and (4) all waters within 100 yards of any High Capacity Passenger Vessel or Alaska Marine Highway System vessel being escorted by USCG surface/air assets or state, federal, or local law enforcement assets within the navigable waters of the Seventeenth USCG District (USCG, 2017).

In general, U.S. VTS systems only provide navigational recommendations or directions to vessels with regards to other traffic in the system. Vessel masters are expected to make weather-related decisions based on their best professional judgement. In PWS, however, there are two areas the USCG can close to crude oil tanker traffic: Port Valdez/Valdez Narrows and Hinchinbrook Entrance. The authority to close Port Valdez/Valdez Narrows when winds are greater than 40 knots is specifically given in federal regulation at §165.1704. There is no regulatory authority for weather-related closures of Hinchinbrook Entrance; it is done with the general agreement of the tanker operators, USCG, and the Alaska Department of Environmental Conservation as an oil spill prevention measure.

6.2 Personnel and Training[14]

The Valdez VTS Operations Center is manned 24 hours per day, seven days a week, typically by two trained operators (also known as watch standers). There is always one supervisor and one operator on shift. If a new operator is being trained, that person would be a third on shift. Additionally, there is one VTS director assigned to the operations center. The director is responsible for all VTS operations, and can also sit in for an operator, if necessary. Operators and supervisors work 12-hour shifts, but for reasons of port security, the VTS director was not able to provide information about shift rotations.

All VTS operators must complete the USCG's two-week VTS school. This training is geared toward VTS operators regardless of which VTS they are assigned to, and so teaches system-wide requirements and practices. According to the PWS VTS director, the VTS school incorporates the use of simulators, but details about how much or in what capacities were not shared.

Once through VTS school, operators are expected to receive OJT at their home VTS. This OJT is guided by a Performance Qualification Standard (PQS) checklist[15] which operator trainees may take up to several months to complete. Once the trainee's mentor signs off on the PQS, the individual may fill a standard operator shift. Operators also have an annual opportunity to be aboard an outbound oil tanker as it transits PWS, but taking advantage of this opportunity is not required.

The VTS director attends the two-week VTS school, but has no other training requirements. A PWS operations manual is available to provide the director with information and guidance on

[14] All information about VTS operator training, PWS VTS staffing, and work shifts was obtained during an interview with PWS VTS Director Carlos Quintero on February 4, 2020.
[15] A copy of the PWS PQS was requested from the VTS director, but was not provided.

the system, and additional assistance can be obtained from operators and supervisors who have been previously qualified in the system and are still stationed in Valdez.

The individuals filling the operator and supervisor roles are a mix of USCG enlisted personnel and civilians (often retired USCG). Enlisted personnel typically rotate out every 3 years, whereas some of the four civilian operators currently employed by the VTS have been in their positions 7 – 10 years. Enlisted personnel typically have a USCG operator endorsement, but have not worked in a VTS previously, nor necessarily had maritime experience.

6.3 PWS VTS Vessel Monitoring and Users

Only vessels that are VMRS/VTS users, as defined in Section 2.0, are officially tracked in PWS. Vessel traffic in the PWS VTS is monitored through three types of sensors:

- 5 radars located at Valdez, Reef Island, and Potato Point (Valdez and Potato Point have two radars each);
- CCTV cameras at locations undisclosed for security reasons; and
- AIS transceivers.

In the PWS VTS Area, vessel tracking falls into four categories:

- Vessels in the radar coverage area,
- AIS-equipped vessels in the radar coverage area,
- Vessels outside the radar coverage area, and
- AIS-equipped vessels outside the radar coverage area.

Depending on where they are located, vessels can be tracked by radar returns, AIS transponder updates, and/or verbal reports (USCG, 2017).

During a tour of the PWS VTS Operations Center and interviews with the director and operators on duty, it was revealed that all five of the PWS radars and the CCTV camera at Hinchinbrook Entrance were non-functional, and had been out of service for some time. The VTS director did not know what repair plan or timeline was in place for the equipment. There had been previous notices from the USCG that the VHF radio transmitter systems were also out of service, but the VTS director clarified that those outages did not affect VTS communications. The affected radio transmitter system was specific to Search and Rescue communications; VTS communications used a separate VHF system.

In PWS, typical VMRS users include oil tankers, tugs and barges (fuel, cargo, and oil spill response), cruise ships, Alaska Marine Highway System ferries, large tour boats, and some fishing tenders. Additional fishing tenders fall under the VTS user designation. Other vessels, such as large yachts, also occasionally transit PWS and would be obligated to meet VMRS or VTS

user requirements if they meet the previously defined criteria. Table 1 lists the companies identified as having vessels that are customary VMRS or VTS users.

Table 1. Customary PWS VTS and VMRS Users

COMPANY	VESSEL TYPE
Alaska Tanker Company	Crude oil tankers
Polar Tankers	Crude oil tankers
Crowley Alaska Tankers	Crude oil tankers
Tesoro Alaska	Chartered crude oil tankers
BP Alaska	Chartered crude oil tankers
Brusco Tug and Barge	General cargo tugs and barges
Alaska Marine Lines	General cargo tugs and barges
Crowley Marine	Fuel tugs and barges
Olympic Tug and Barge	Fuel tugs and barges
Sampson Tug and Barge	Fuel tugs and barges
Kirby Offshore Marine	Fuel tugs and barges
Edison Chouest Offshore	Oil spill response tugs and barges
Alyeska Pipeline Service Company	Spill prevention and response small boats
Stan Stephens Glacier and Wildlife Cruises	Tour boats
Lu-Lu Belle Glacier Wildlife Cruises	Tour boat
Alaska Marine Highway System	Passenger ferries
Silver Bay Seafoods	Contracted fishing tenders
Peter Pan Seafoods	Contracted fishing tenders

It is important to note that the most numerous vessels in PWS are neither VMRS or VTS users, including seiners, gillnetters, some fishing tenders, landing crafts, most pleasure boats, fishing charter boats, and other non-towing vessels under 20 meters (about 65 feet). These vessels are not required to monitor VHF channel 13 or check in with the USCG when in the VTS, and therefore may not be aware of the presence or movements of larger vessels in the area. Additional vessels not required to follow VMRS or VTS requirements are military vessels (Navy and USCG frequent PWS) or others exempted by the USCG.

Table 2 lists the quantitative data compiled by the NTSB for PWS. More recent data was not available from the PWS VTS director. The numbers of vessel transits since 2014 are not likely to

be significantly different than those recorded for 2014 as the majority were made by seasonal tour operators and tugs with cargo/fuel barges. Those operators did not have significant changes in their operations through 2019. No records were located for marine incidents involving VTS users on the USCG Incident Investigation Reports website in PWS after 2014.

Table 2. Annual Vessel Data for PWS, 2010 – 2014 (NTSB, 2016)

PARAMETER	2010	2011	2012	2013	2014
Vessel transits[1]	22,255	12,769	7,104	6,860	6,849
Vessel incidents[2]	2	1	0	0	0
Incident rate[3]	0.09	0.08	0.00	0.00	0.00

1. According to the VTS director, a new transit would be recorded each time a vessel entered the VTS (e.g., a tour boat on a round-trip day tour from Valdez to Mears Glacier would record two transits).
2. Vessel incidents include all collisions, allisions, and groundings for each year.
3. Collision, allision, and grounding incident rate per 1,000 transits calculated annually.

6.4 PWS VTS User Feedback

Users of the PWS VTS system were contacted to provide their opinions about working within the VTS and with the USCG operators. These contacts were not intended to provide any sort of quantitative data, but instead to obtain a general impression of the VTS from the users' perspectives.

The users were asked:

1. How often do you transit the VTS?
2. What are your typical communications with the USCG? What should they be? Is there information you'd like to get but don't typically now?
3. Do you ever get information on weather, visibility, or hazardous conditions? Would you want it?
4. Have you ever been denied entry to the VTS? Why? What did you have to do instead?
5. Have you ever been called by the USCG to correct your course, give direction, etc.? Circumstances?
6. Do you have any concerns about or recommendations for the VTS system, either communications or standard protocols?
7. How does the PWS VTS compare to other VTS systems you have transited?

For those users with whom verbal interviews were conducted, follow-up questions were sometimes asked based on the responses given.

Either written or verbal feedback was received from 19 vessel captains with Polar Tankers, Crowley Alaska Tankers, Stan Stephens Glacier and Wildlife Cruises, Brusco Tug and Barge, Kirby Offshore Marine, and Edison Chouest Offshore. Other companies were contacted via email or telephone, but no response was received.

In general, the feedback from the users was positive, and none reported any concerns about working within the PWS VTS or with the USCG operators. All agreed that their communications with the operators was generally limited to arrival and position declarations, and that they receive notification if there was ice in the traffic lanes. Most respondents indicated that they rely on other sources for weather information, but that the operators would occasionally notify them of hazardous conditions, particularly for Hinchinbrook Entrance. No respondent wished they received more or different information from the VTS operators. None of the respondents had ever been denied entry to the VTS, and only two tanker captains noted that they had been required to stay in PWS due to closure conditions at Hinchinbrook Entrance. Those respondents (which was most of them) who had worked in other U.S. VTS systems said that the PWS system was similar to the others, and a few said it was easier to work in because there is comparably so little vessel and radio traffic in PWS.

6.5 Fishing Vessel Captain Feedback

In addition to official VRMS/VTS users, several fishing vessel captains were also contacted for their feedback on the system. This study focused on salmon seine boats as they are the commercial fishing vessels most likely to encounter VTS users while fishing. There are 225 salmon seine permits for PWS, and so potentially that many vessels fishing from June to September. Not all are fishing in the same area, nor do all fish within the VTS boundaries. Vessels fishing in the VTS boundaries are commonly at Rocky Point (near Bligh Reef) or in Port Valdez and Valdez Arm, including the Valdez Narrows. Communication with the VTS operators is particularly important for those fishing in Valdez Narrows as they are the ones most likely to be in the close vicinity of VTS users.

As noted in Section 6.3, fishing vessels under 65 feet long (which includes all commercial salmon fishing boats in Alaska) are not required to carry AIS and they are not required to monitor channel 13, the VHS channel used by the VTS (channel 16 is the standard channel all vessels are required to monitor). Nonetheless, the fishing vessel captains interviewed indicated that they did monitor channel 13, particularly while fishing within the VTS area, but this is not necessarily the norm for all vessels. They said that they did want to be aware of when large vessels, particularly tankers, were going to be transiting PWS so that they could adjust their fishing accordingly. Given that all fishermen do not monitor channel 13, they thought it would be appropriate for notification of vessel movements in certain areas (principally Valdez

Narrows) to also be broadcast on channel 16 during fishing openers. Some captains also said that it would be appreciated if the tanker schedules would also take into account fishing vessel openers so that they would avoid going through Valdez Narrows when boats were actively fishing.

One recommendation the fishing vessel captains did have was for the VTS to broadcast on a higher wattage or use repeaters that allowed for more geographic coverage. For example, if the VTS is talking on channel 13 to a tanker entering through Hinchinbrook Entrance and using the repeater for that area, it is difficult for other vessels in other parts of the sound to hear the communication and understand when the tanker might be in the area in which they are fishing.

7.0 NTSB SAFETY CONCERNS

As noted in Section 4, the NTSB identified four areas of safety concern:

1. Variation in the use of USCG VTS authority,
2. Inadequate VTS watch stander training and qualification,
3. VTS system limitations,
4. Insufficient safety risk management of VTS areas (NTSB, 2016).

The majority of their comments and recommendations could only be addressed at a national level and were beyond the ability of the local VTS centers to address themselves. The PWS VTS director was asked about changes that had been put into effect after the report was published, but as he had not been involved with the VTS system prior to 2018, he was not aware of specific changes that had been implemented. Repeated attempts were made to interview a former PWS VTS director to try to obtain some understanding of changes in the system, but the attempts were unsuccessful.

For two of the areas of safety concern there is potential for local change and improvement: VTS authority and communication and watch stander training and qualification.

7.1 VTS Authority and Communications

Noteworthy concerns and recommendations in the 2016 NTSB report centered around the uses of authority given to the USCG VTS system and communications with vessels. All watch standers are trained to follow an explicit standard of effectiveness for all traffic management activities (*monitor*, *inform*, *recommend*, and *direct*), a training that was confirmed by the VTS staff interviewed at the PWS operations center. As a result, they typically only point out hazards that vessel operators appear to have not seen, but do not tell the operators what to do to avoid the hazards.

Opinions have been expressed by some individuals in PWS that the PWS VTS should operate more like an air traffic control system in which the USCG would have and use the authority to direct the movements of vessels. When this idea was raised with the VTS director, he commented that one difference between the two systems was that air traffic controllers have knowledge of the presence and flight plans of all aircraft in the area, whereas the VTS does not have that information about all of the vessels in the system. He also confirmed the USCG expectation that the vessel masters are in the best position to ensure the safety of their vessels as only they have the full picture of the conditions under which they are operating.

Changes to the interpretation and use of USCG authorities will have to be made at a national level. There can be no reasonable expectation that the PWS VTS will operate counter to their training or without direction from higher authorities.

One concern voiced by the PWS VTS director centered on the need to be able to communicate with the PWS fishing vessel fleet. There is no central organization to which all fishermen belong which could be an avenue for getting information out to all boats. Previously, the USCG has tried to reach out to fishermen through annual oil spill response training, local fisherman's organizations, and fish processing companies, but these means do not necessarily reach the entire fleet and are dependent on the cooperation of the organizations. When asked, the fishermen interviewed agreed that if the USCG had an email and/or text message listserv which they could join, they would be willing to do so. They noted that for messages that needed to be seen right away during the fishing season, text messaging would be better than emails as they do not typically monitor emails during fishing openers.

7.2 Watch Stander Training and Qualifications

In their 2016 report, the NTSB made the following recommendations to the USCG regarding watch stander training and qualifications:

1. Incorporate additional training that emphasizes realistic VTS simulation exercises, including detecting and responding to unsafe traffic situations, into initial training and proficiency requirements for all VTS watch standers in the USCG VTS system.
2. Require standard OJT mentor selection criteria, including appropriate vessel traffic service operator work experience levels and instructor training requirements, for all OJT mentors.
3. Require all VTS watch supervisors to achieve a VTS operator qualification and complete a minimum work experience requirement as an operator before serving as a supervisor.
4. Modify the "Vessel Traffic Service National Standard Operating Procedures Manual," VTS center internal operating procedure manuals, and training curricula, as necessary, to ensure that VTS watch standers share a common understanding of how to identify and respond to situations requiring navigational assistance.
5. Ensure that vessel traffic service watch standers are trained in and demonstrate proficiency with the navigation rules and regulations by passing the Coast Guard Deck Watch Officer exam, the Merchant Mariner Credentialing Rules of the Road exam, or another appropriate knowledge test.

According to the information provided by the PWS VTS director, although not a complete description of the USCG training program, it would appear that the above recommendations apply to the PWS system. Many of the recommendations (e.g., use of simulators in training and qualification requirements) are not under the control of the PWS VTS center. One area, however, is: local knowledge and understanding of the PWS VTS region.

Based on input from PWS tour boat operators and fishermen, as well as comments made by the VTS director, watch supervisor, and watch stander on shift during a tour of the VTS center, knowledge of the PWS operating area should be emphasized during training. During the tour, all three individuals expressed surprise when it was mentioned that fishing vessels are not all required to carry AIS or to monitor channel 13; they all assumed the boats would be monitoring channel 13 at all times. Additionally, when describing the boundaries of the VTS area, the director commented that no one goes to Columbia Glacier, a destination visited daily during the summer season by the local tour boat operators who must report their destinations to the VTS before leaving the Valdez harbor. The tour boat operators said that they have provided the USCG with a standing invitation for watch standers to ride their vessels in order to familiarize themselves with the area and vessels in it, but the USCG has told them they cannot take advantage of the offer as it is seen as a perk rather than as training. While the watch standers are allowed to take one trip on a tanker annually, doing so is not a requirement.

8.0 CONCLUSION

After reviewing international VTS standards and systems, the 2016 NTSB report "An Assessment of the Effectiveness of the US Coast Guard Vessel Traffic Service System," and the PWS VTS system, it appeared that the PWS system is managed within the expectations of the USCG. Likewise, it might be assumed that the USCG manages their system in accordance with international standards, but due to reasons of port security and federal Freedom of Information Act requirements it was not possible to get detailed information about many aspects of PWS VTS operations, including how U.S. standards may match those internationally.

One of PWSRCAC's goals for this project was to have an understanding of the best available technology in use worldwide for VTS systems. Unfortunately, it was not possible to obtain specific information about the hardware (radars, AIS receivers, operations center displays, etc.) for any of the systems investigated, including the one in PWS.

Despite limitations on the ability to obtain some information, this review resulted in several recommendations for the USCG with regards to PWS VTS operations.

RECOMMENDATION 1: ***Conduct repair and maintenance on the PWS radars and CCTV cameras to bring them back into operation***

Given that the majority of the vessels in PWS do not have, and are not required to have, AIS transmitters on board, having operational radars is critical to the VTS watch standers' ability to see vessel traffic and help avert possible incidents that could result in harm to human life or the environment. The non-functional camera at Hinchinbrook Entrance is important to the ability of the watch standers to observe weather conditions and make decisions about closing the entrance to tanker traffic.

The VTS director indicated that the decisions about repairing the systems are made at the USCG District 17 level, not locally. Opportunities to encourage the district office to ensure repairs are made and adequate maintenance is conducted in the future should be acted upon.

RECOMMENDATION 2: ***Ensure that system-specific OJT is sufficient for watch standers and supervisors to understand the geography of and vessels in PWS***

The USCG has said that the purpose of VTS systems is "to provide active monitoring and navigational advice for vessels in particularly confined and busy waterways." In order for the PWS VTS watch standers to provide navigational advice that leads to increased safety of vessels and, in turn, protection of human life and the environment, they need to have a solid understanding of the geography of and vessels in PWS.

At a minimum, the VTS director, supervisors, and watch standers should be encouraged to take advantage of opportunities to ride vessels (tour boats, tankers) out of Valdez to gain familiarity

with the PWS region. The VTS director indicated that such rides, particularly on tour boats, was seen a perk that the personnel could not legally accept. This perception needs to change so that the trips are viewed as training opportunities, not recreational activities.

RECOMMENDATION 3: Develop an automated communication system for vessel operators

As noted in Section 7.1, both the USCG and commercial fishermen have been frustrated by the lack of efficient communication methods. Undoubtedly there are other small vessel owners (e.g., fishing charter boats) with whom it is also important that the USCG be able to have effective communications.

The PWS VTS director indicated that he did not have any sort of automatic email system, but instead had to create an email list for each message that he sent. There are a wide variety of email list management software packages available, many of which allow recipients to opt into which types of messages they receive and how often. It is recommended that the USCG research and select options for VTS centers to use with local vessel owners, remembering that this service should not be limited to official VTS or VMRS users. This service could then be used to distribute a wide variety of USCG communications such as Notices to Mariners, Marine Safety Information Bulletins, and other special information, and help ensure that the intended recipients are indeed receiving the messages.

Additionally, a similar service for cell phone text messaging would allow the USCG to send notices to vessels, particularly fishing vessels, that need to be received as soon as possible. Drawing attention to the passage of an oil tanker transiting the Valdez Narrows during a fishing opener is an example of when this service might be used. While fishing vessels do monitor channel 16 consistently, they may not hear a radio call if they are working on deck, but they would see a text message once back in the wheelhouse, if not sooner.

RECOMMENDATION 4: Broadcast VTS user transit information on channel 16

It is important that all vessels in PWS be aware of the movement of VTS/VMRS users in order to be able to avoid incidents with them and avoid being in the tanker lanes when a tanker is transiting PWS. However, many of the vessels that are not users do not regularly monitor channel 13, the official VTS broadcast channel. It is recommended that the VTS broadcast information about large vessel (tanker, cruise ship, etc.) transits on channel 16 to help ensure everyone hears them. Doing so is particularly important during commercial fishing openers, especially those in Valdez Narrows where many boats can be working in a very small area.

RECOMMENDATION 5: *Use radio repeaters that allow all vessels in PWS monitoring channel 13 to be able to hear information about vessel transits*

In addition to formal broadcasts, another way vessels can obtain information is by hearing when VTS users call the VTS watch standers to report their location in the system. The VTS use of local repeaters that only allow radio transmissions to be heard in a small area limits ability of others monitoring channel 13, as many fishermen do, to hear this information and plan their actions accordingly. Broadcasting on higher range repeaters or using more of them would improve the ability all PWS vessels to understand the potential hazards in their area.

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APPENDIX A

The following is a list of relevant International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) standards, guidelines, and recommendations for VTS systems which were reviewed during the development of this report.

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