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Report to the Committee on Homeland Security, House of Representatives

March 2009

MARITIME SECURITY

Vessel Tracking Systems Provide Key Information, but the Need for Duplicate Data Should Be Reviewed

GAO-09-337

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Highlights

Highlights of GAO-09-337, a report to the Committee on Homeland Security, House of Representatives

Why GAO Did This Study

U.S. ports, waterways, and coastal approaches are part of a system handling more than $700 billion in merchandise annually. With the many possible threats—including transportation and detonation of weapons of mass destruction, suicide attacks against vessels, and others—in the maritime domain, awareness of such threats could give the Coast Guard advance notice to help detect, deter, interdict, and defeat them and protect the U.S. homeland and economy. GAO was asked to review the Coast Guard's efforts to achieve awareness about activity in the maritime domain. This report addresses: the extent to which the Coast Guard (1) has vessel tracking systems in place, (2) can use these systems to track vessels that may be threats, and (3) has coordinated the development and implementation of these systems. To answer these questions, GAO analyzed relevant statutes, regulations, and plans for vessel tracking systems, compared the roles of the planned systems, and interviewed appropriate officials.

What GAO Recommends

To ensure efficient use of resources, GAO recommends that the Commandant of the Coast Guard determine the extent to which duplicate vessel tracking information from LRIT and commercially provided long-range AIS is needed to accomplish Coast Guard missions, particularly in light of information already available through national technical means. DHS agreed with this recommendation.

To view the full product, including the scope and methodology, click on GAO-09-337. For more information, contact Stephen L. Caldwell at (202) 512-9610 or caldwells@gao.gov.

What GAO Found

At sea or in U.S. coastal areas, inland waterways, and ports, the Coast Guard is currently relying on a diverse array of vessel tracking systems operated by various entities, but its attempts to develop systems to track vessels at sea are facing delays. For tracking vessels at sea, the Coast Guard uses existing national technical means—classified methods of tracking vessels—and plans to obtain vessel identification and tracking information from two more sources, long-range identification and tracking system (LRIT), and commercially provided long-range automatic identification system (AIS). However, one source of this information has just become available and the other has been delayed due to technical and operational difficulties. International LRIT requirements generally came into effect on January 1, 2009. The Coast Guard estimates that commercially provided long-range AIS will be operational in 2014. For tracking vessels in U.S. coastal areas, inland waterways, and ports, the Coast Guard operates a land-based AIS, and also either operates, or has access to, radar and cameras in some ports.

The existing and planned sources of vessel tracking information may allow the Coast Guard to track larger vessels at sea, but systems and other equipment that track smaller and noncommercial vessels in coastal areas, inland waterways, and ports may prove ineffective in thwarting an attack without advance knowledge. The means of tracking vessels at sea—national technical means, LRIT, and commercially provided long-range AIS—are potentially effective, but each has features that could impede its effectiveness. The systems used in U.S. coastal areas, inland waterways, and ports—AIS, radar, and video cameras—have more difficulty tracking smaller and noncommercial vessels because they are not required to carry AIS equipment and because of the technical limitations of radar and cameras. In studies GAO reviewed and discussions with maritime stakeholders, there was widespread agreement that vessel tracking systems and equipment will be challenged to provide a warning if a small vessel is moving in a threatening manner.

The Coast Guard has not coordinated its plans for obtaining vessel tracking information at sea, and is planning on obtaining potentially duplicative information, but in coastal areas, inland waterways, and ports, the various tracking methods complement each other. Once operational, the two new planned means for tracking vessels at sea—LRIT and commercially provided long-range AIS—will both provide vessel identification and position information for almost all the same vessels. Commercially provided long-range AIS provides additional information about each vessel and its voyage, but almost all of that information is available through reports filed by vessel operators. The primary need cited by the Coast Guard to develop both systems—to detect anomalies—can be met by the national technical means already operational, combined with information from the reports filed by vessel operators and LRIT. Furthermore, the Coast Guard has not coordinated or analyzed the information each source can provide and the need for information from both.

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Abbreviations

AIS	automatic identification system
DHS	Department of Homeland Security
DOD	Department of Defense
HSPD-13	Homeland Security Presidential Directive-13
IMO	International Maritime Organization
LRIT	long-range identification and tracking
MDA	Maritime Domain Awareness
MISNA	Maritime Information Service of North America
MTSA	Maritime Transportation Security Act of 2002
NAIS	Nationwide Automatic Identification System
RFP	Request for Proposal
SAFE Port Act	Security and Accountability For Every Port Act of 2006
SOLAS	International Convention for the Safety of Life at Sea, 1974

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United States Government Accountability Office
Washington, DC 20548

March 17, 2009

The Honorable Bennie G. Thompson
Chairman
The Honorable Peter T. King
Ranking Member
Committee on Homeland Security
House of Representatives

The U.S. maritime transportation system is one of the nation's most valuable infrastructures and is a potential target for terrorists. Because U.S. ports, waterways, and coastal approaches are part of an economic engine handling more than $700 billion in merchandise annually, an attack on this system could have a widespread impact on global shipping, international trade, and the world economy. Protecting this system is a daunting undertaking, in part because it is so vast: the United States has over 95,000 miles of coastline, 361 ports (including 8 of the world's 50 highest-volume ports), and 10,000 miles of navigable waterways. Nearly 700 vessels arrive from overseas in U.S. ports daily, while domestic vessels include fleets of tugs, barges, and cargo vessels, along with 110,000 commercial fishing vessels and over 70 million recreational boats. To protect the nation's ports and waterways, the Coast Guard must be able to identify those who intend to do harm while at the same time minimize disruption to the maritime transportation system. To gain a better understanding and knowledge of vessels, the companies that own and operate them, the cargo they carry, and the people who travel on them, the U.S. government, largely through the U.S. Coast Guard, has enacted programs and systems for gathering information about the maritime transportation system. This effort is called Maritime Domain Awareness (MDA).

The National Plan to Achieve Maritime Domain Awareness—a part of The National Strategy for Maritime Security—lays out the need for MDA. The plan states that the maritime domain provides an expansive pathway around the world that terrorist organizations have recognized. Such organizations realize the importance of exploiting the maritime domain for the movement of equipment and personnel, as well as a medium for launching attacks. The Coast Guard needs timely awareness of the maritime domain and knowledge of threats in order to detect, deter, interdict, and defeat adversaries.

The threats to the United States and its economy from the maritime domain are many and varied. Rogue governments and terrorist groups could use large merchant vessels to move weapons of mass destruction or powerful conventional explosives for detonation in a port or alongside an offshore facility. Terrorists have shown that they have the capability to use explosives-laden suicide boats as weapons. This capability could easily be used to attack other vessels, port facilities, or offshore platforms. Modern day pirates and other criminals are well organized and equipped to conduct smuggling of people, drugs, weapons, and other contraband.

Vessel tracking is vital to the MDA effort, both when vessels are at sea and when they are in coastal areas, inland waterways, and ports. Vessel tracking at sea involves either using national technical means or requiring vessels to carry equipment that broadcasts radio signals with information about their identity, position, speed, and course.[1] When radio signal-broadcasting systems were originally developed, however, they were used primarily for such purposes as search and rescue or improved navigation safety, not homeland security. The Maritime Transportation Security Act of 2002 (MTSA) enacted the first federal vessel tracking requirements to improve the nation's security.[2] It mandated that certain vessels operate an automatic identification system (AIS) while in U.S. waters. On board vessels, AIS equipment transmits information such as the name of the vessel, its position, speed, course, and destination to receivers within range of its broadcast, allowing these vessels to be tracked when they are operating in coastal areas, inland waterways, and ports. Receivers may be installed on other vessels, land stations, or other locations. Coast Guard personnel, known as watch standers, monitor screens transmitting information on the tracked vessels.

MTSA also allowed the development of a long-range automated vessel tracking system that would track vessels at sea, based on existing onboard radio equipment and data communication systems that can currently transmit the vessel's identity and position to rescue forces in the case of an emergency. Later, the Coast Guard and Maritime Transportation Act of 2004 amended MTSA to require, rather than just allow, the development of

[1]National technical means is an unclassified term used to describe vessel tracking through classified means. The specific capabilities and methods of tracking using national technical means involve the use of national security assets, are classified, and cannot be discussed in this report.

[2]Pub. L. No. 107-295, 116 Stat. 2064 (2002).

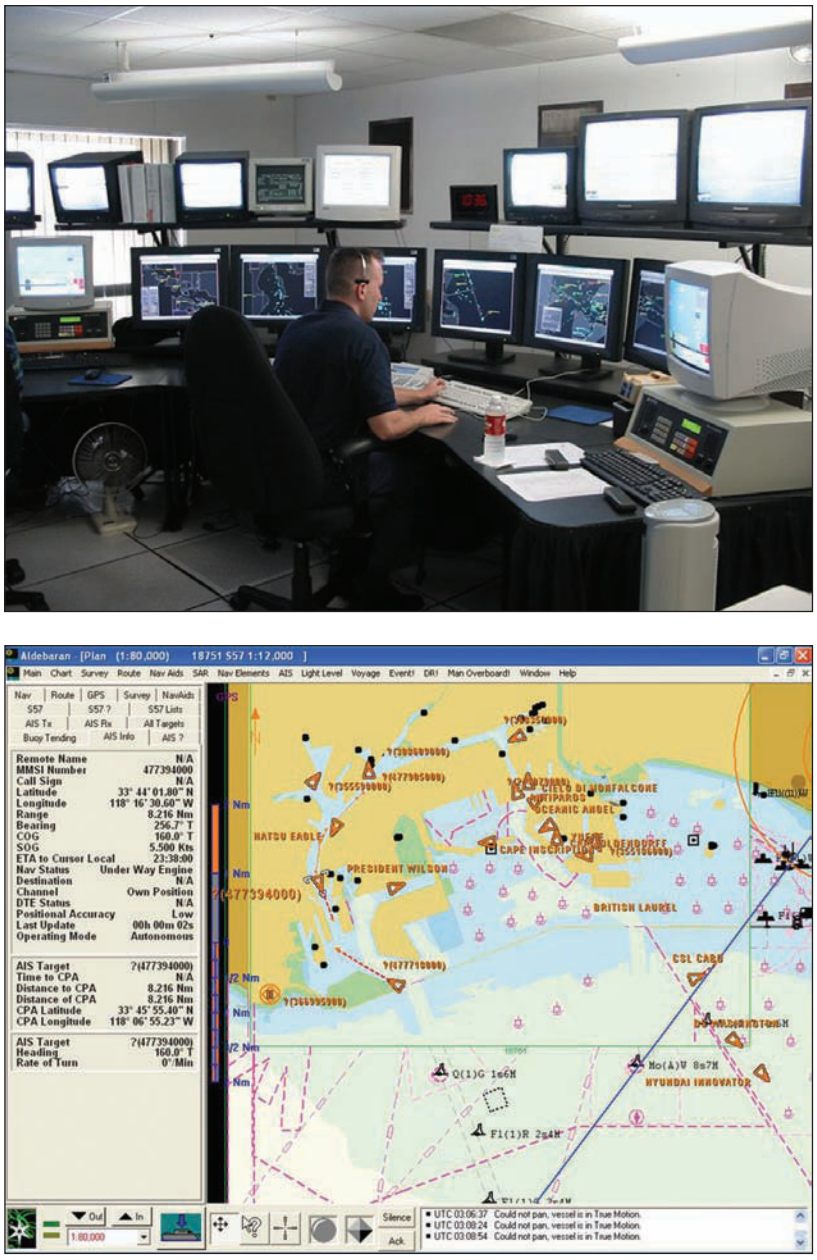
a long-range tracking system.[3] Current laws and implementing regulations for AIS apply in general to larger commercial vessels, such as those 300 gross tons or more, not to smaller vessels, such as most commercial fishing boats or recreational boats. Coast Guard regulations on long-range tracking generally apply to passenger ships and cargo ships 300 gross tons or more and to mobile offshore drilling rigs. The Coast Guard uses other means to track smaller vessels, ranging from cameras and radar to partnerships with marine operators who can act as "eyes and ears" to help identify suspicious or unusual behavior. To identify and track vessels, it is crucial that the Coast Guard coordinate the various systems to maximize coverage and eliminate unnecessary duplication. The Coast Guard and Maritime Transportation Act of 2004 recognized the need for the coordination of maritime information collection, including vessel-tracking information, and the avoidance of unwanted redundancy—or duplication—in these efforts.

Since the enactment of MTSA, the use of AIS has evolved. At the time MTSA was enacted, only certain areas—known as Vessel Traffic Service or Vessel Movement Reporting Service areas—as well as the St. Lawrence Seaway operated or planned AIS land stations.[4] These services used vessel position information reported by AIS to improve navigation safety and warn vessels of potential navigation hazards. Coast Guard regulations implementing MTSA required vessels in these areas, and those on international voyages to operate AIS equipment. See figure 1 for a Vessel Traffic Service watch stander and an example of an AIS screen view.

[3]Pub. L. No. 108-293, 118 Stat. 1028 (2004).

[4]Vessel Traffic Service and Vessel Movement Reporting Service areas are waterways where due to their confined or busy circumstances and the probability of maritime accidents the Coast Guard provides monitoring and navigational advice. Coast Guard regulations list the following areas as Vessel Traffic Service or Vessel Movement Reporting Service areas: the waters around Houston-Galveston, Texas; Los Angeles/Long Beach, California; Louisville, Kentucky during high water; Morgan City, Louisiana; New Orleans, Louisiana; New York, New York; Port Arthur, Texas; Prince William Sound, Alaska; Puget Sound, Washington; San Francisco, California; and St. Mary's River, Michigan.

Figure 1: Vessel Traffic Service Watch Stander and AIS Screen View



Source: U.S. Coast Guard.

The U.S. and Canadian governments and maritime industry groups, such as maritime exchanges that represent private sector stakeholders in ports, also realized that AIS information could be used for the efficient

scheduling of maritime operations along waterways and in ports. For example, with accurate vessel position information, St. Lawrence Seaway operators could minimize waiting time at locks located along the seaway by scheduling vessels to arrive when the locks' gates were open and the water in the locks was at the same level as the vessel. Similarly, maritime exchange members could schedule tugs and longshore workers to be ready as the vessels arrived. To help develop their vessel tracking efforts, a group of maritime exchanges formed the Maritime Information Service of North America (MISNA). More recently, the Coast Guard expanded its AIS monitoring capabilities to cover 55 critical ports and 9 coastal areas. The Coast Guard is further expanding AIS through a major acquisition program called the Nationwide Automatic Identification System (NAIS), which will be carried out in three contracting increments. Even as NAIS expands the area that can be monitored using AIS, the primary means of tracking vessels in U.S. coastal areas, inland waterways, and ports is still AIS, which can only track vessels that carry and operate AIS equipment. Currently, only larger vessels, such as commercial cargo vessels, are required to carry this equipment, but the Coast Guard issued a Notice of Proposed Rulemaking in December 2008 that would increase the types of vessels required to carry AIS equipment and the locations where they must do so. While larger vessels can possibly carry terrorists as passengers or crew and contraband or weapons of mass destruction as cargo, they can also be the target of attacks by smaller vessels such as recreational boats. AIS cannot track these smaller vessels unless they carry and operate AIS equipment, which they are currently not required to do.

Achieving MDA is particularly challenging because it requires working with many nations with differing maritime standards and levels of technology. The International Maritime Organization (IMO), an agency of the United Nations to which the United States belongs, is the international body responsible for improving maritime safety, including combating acts of violence or crime at sea. The organization primarily regulates maritime safety and security through the *International Convention for the Safety of Life at Sea, 1974* (SOLAS), as amended, an international treaty with 159 contracting, or signatory, states. In 2006, amendments to the treaty were adopted that mandated the creation of an international long-range identification and tracking (LRIT) system that requires vessels on international voyages to report their locations; the creation of data centers that will, among other roles, receive LRIT information from the vessels; and an information exchange network, centered on an international data

exchange, for receiving and transmitting LRIT information to authorized nations.[5]

As acknowledged by such groups as the 9/11 Commission, no amount of money or effort can totally insulate seaports from attack by a well-funded and determined enemy. Because the United States cannot afford to protect itself against all risks, Congress has charged the Department of Homeland Security (DHS) with coordinating homeland security programs through the application of a risk management framework. Broadly defined, risk management is a process that helps policymakers assess the risks that exist, strategically allocate finite resources, and take actions under conditions of uncertainty. For vessel tracking, this effort requires identifying high-risk vessels as a priority and developing a layered system of security to reduce the risks associated with them. An example of the use of risk management is the Coast Guard's effort to determine which vessels bound for the United States may pose the greatest threat to the United States and which, given the limited resources available to the Coast Guard, should be boarded to determine if they pose an undue risk.

You requested that we evaluate efforts to improve MDA by assessing the Coast Guard's vessel tracking efforts. This report answers three questions:

- What are the Coast Guard's vessel tracking systems and to what extent does the Coast Guard have these systems in place?
- To what extent will the Coast Guard be able to use these systems to track vessels that may prove to be threats?
- To what extent has the Coast Guard coordinated the development and implementation of its vessel tracking systems to maximize coverage and minimize unnecessary duplication?

[5]Under the IMO regulation only certain countries are allowed to receive LRIT information. A vessel's position information is always available to the country that registered the vessel. A country can typically receive position information from vessels that sail within 1,000 nautical miles of its coastline, even if it is not the destination of the vessel. The destination country of a vessel can receive position information when a vessel states its intention to enter a port or place within that country. For example, vessels sailing to the United States are typically required to report their intention to enter a U.S. port 96 hours prior to arrival. At typical speeds of ocean-going vessels, this is approximately 2,000 nautical miles off the U.S. coastline.

This is a public version of a classified report we issued in March 2009 that contained information related to efforts to track vessels and prevent attacks. The Department of Defense (DOD) and DHS deemed specific details regarding methods used by the Coast Guard and others for long-range tracking of vessels at sea, as well as information on the difficulties involved in detecting threatening activities by vessels in U.S. coastal areas, inland waterways, and ports, as confidential or for official use only, which must be protected from public disclosure. Therefore, this report omits those details. Although information provided in this report is more limited in scope, it addresses the same questions as the classified report. Also, the overall methodology used for both reports is the same. The conclusions and recommendation contained in our March 2009 classified version of this report remain generally unchanged.

To determine the Coast Guard's vessel tracking systems and the extent to which the Coast Guard has them in place as well as the extent to which these systems are able to track vessels that may prove to be threats, we reviewed relevant federal statutes and regulations including MTSA, the Coast Guard Maritime Transportation Act of 2004, and the Security and Accountability For Every Port Act of 2006 (SAFE Port Act). We analyzed relevant international regulations regarding vessel tracking developed through the IMO. We also analyzed descriptive and analytic information and reports regarding the overall plans for vessel tracking system infrastructure, studies of coverage areas, progress reports, and any information regarding delays of the implementation of the systems. In addition, we interviewed Coast Guard officials responsible for the tracking systems and Coast Guard personnel with MDA intelligence-gathering responsibilities. We also conducted site visits to a non-probability sample of Coast Guard field units. We selected these field units based on their current vessel tracking capability considering their assets, technology, and missions. While the information we obtained at the locations we visited cannot be generalized across the United States, the stakeholders in these locations provided us with a general overview and perspective on vessel tracking activities and capabilities at the selected locations. In addition to interviewing Coast Guard officials, we also interviewed officials at federal, state, and local agencies that have a role in MDA and vessel tracking, such as the Federal Bureau of Investigation's Maritime Liaison Agents, and state and local police officials. Finally, we interviewed representatives from the maritime industry, such as officials from commercial maritime exchanges that represent the commercial interests at ports, to gain private sector perspectives.

To determine to what extent the Coast Guard coordinated the development and implementation of its vessel tracking systems, we conducted a comparative analysis on the performance and roles of LRIT, commercially provided long-range AIS, and national technical means. We reviewed relevant technical documentation regarding all three tracking systems, and interviewed knowledgeable Coast Guard officials responsible for the development and implementation of the tracking system to determine the progress and capabilities of each tracking system to date. We conducted this performance audit from November 2007 to March 2009 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Results in Brief

At sea or in U.S. coastal areas, inland waterways, and ports, the Coast Guard is currently relying on a diverse array of vessel tracking systems operated by various entities, but its efforts to use newer, more comprehensive systems are facing delays.

- For tracking vessels at sea, the Coast Guard uses existing national technical means and plans to utilize two additional sources of offshore vessel identification and tracking information. The Coast Guard anticipated that the first of these new sources, LRIT, would be able to track more than 40,000 vessels worldwide by December 2008. Due to preexisting IMO requirements, most of these vessels already have the necessary equipment to allow tracking by the Coast Guard and others once LRIT becomes operational. Although the Coast Guard expected to begin to receive some LRIT reports on schedule, it acknowledged that not all countries would be ready to participate. An additional source of offshore vessel identification and tracking information, commercially provided long-range AIS, is expected to provide more information than the LRIT system. Once available, the Coast Guard expects commercially provided long-range AIS to be able to track vessels up to 2,000 nautical miles at sea. However, the contractor working on the project for the Coast Guard experienced a number of delays. As currently scheduled, the Coast Guard does not expect commercially provided long-range AIS to be fully operational until 2014.

- In U.S. coastal areas, inland waterways, and ports, the Coast Guard operates a land-based AIS system as the primary means of tracking

AIS-equipped vessels, and also either operates, or has access to, other tracking systems in various locations. The Coast Guard can track AIS-equipped vessels in 55 critical ports and 9 coastal areas around the country, out to approximately 24 nautical miles from the coast using the land-based AIS system currently in place. The Coast Guard plans to expand land-based AIS tracking coverage to 50 nautical miles from the coast nationwide, but has experienced several delays in the contracting process for the project due to the need to revise the Request for Proposal. In some ports, the Coast Guard also uses camera or radar networks operated either by Coast Guard personnel or by other entities which allow some tracking of vessels that do not operate AIS equipment. Additionally, in some ports and river systems the Coast Guard has access to tracking systems installed by other maritime stakeholders. For example, local Coast Guard units have access to information from AIS systems operated by maritime organizations on the Delaware and Columbia Rivers, access to cameras and radar installed by the Navy at its major home ports, and access to some state transportation department cameras located near bridges and other critical infrastructure.

The existing and planned tracking systems may allow the Coast Guard to track larger vessels traveling at sea. However, given the number of potential threats in many areas and short period of time in which to respond to a threat, thwarting an attack by a smaller vessel without advance knowledge of the threat may prove challenging even with available systems and other equipment that track smaller and noncommercial vessels in coastal areas, inland waterways, and ports.

- The three existing and planned sources of offshore vessel identification and tracking information—national technical means, LRIT, and commercially provided long-range AIS—if implemented as planned, are potentially effective, but each has features that could impede its effectiveness. Each system's ability to track vessels has been demonstrated. National technical means, for example, have performed this function for many years. Similarly, although information from both LRIT and the commercially provided long-range AIS systems is not yet fully available to the Coast Guard, both have been demonstrated as effective in tracking vessels. LRIT's effectiveness in tracking vessels offshore has been demonstrated by the Maritime Information Service of North America which, in conjunction with the Coast Guard, tracked vessels in the North Pacific and off the coast of Alaska. AIS, while not yet tested at sea, is a proven technology where installed in coastal areas, inland waterways and ports. However, the Coast Guard acknowledges that the deployment of commercially provided long-

range AIS is not far enough along to know whether the technology will work as planned or what it will ultimately cost. In addition, both the LRIT and AIS systems are dependent on the good will of the vessels' owners and operators: vessel operators can turn off AIS and LRIT systems. National technical means are capable of tracking vessels, but the classified tracking information cannot be passed to staff of other agencies without proper clearances.

- The systems used in U.S. coastal areas, inland waterways, and ports—primarily AIS, but also radar and video cameras in some ports—are less effective in tracking smaller and noncommercial vessel traffic in these locations because these vessels are generally not required to carry AIS equipment and because of the technical limitations of radar and cameras. Although most large commercial vessels arriving from overseas should still be transmitting AIS information and the Coast Guard can readily track them, noncommercial vessels of any size, commercial vessels on domestic voyages in many locations, and vessels smaller than 65 feet generally do not need to carry AIS equipment or transmit AIS information. A Notice of Proposed Rulemaking issued by the Coast Guard in December 2008, however, would require AIS to be carried by more commercial vessels in all navigable waterways of the United States.[6] Although some ports have video cameras and radar, these systems have limitations: radar has difficulty detecting small vessels, especially when the vessels are sailing in high seas, and cameras may not cover the entire port or may not work in bad weather or at night.

- In studies we reviewed and discussions with maritime stakeholders, there was widespread agreement that detecting threatening activity by vessels is very difficult without prior knowledge. The Coast Guard is developing software programs for tracking the expected activity of a port over time and warning the Coast Guard when unexpected activity occurs, but according to Coast Guard officials, such programs will take years to be fully operational. In part because of the need for advance knowledge of a threat, officials representing all the Coast Guard sectors we visited, as well as members of the intelligence community and local law enforcement in locations we visited, said they have developed cooperative relationships and mechanisms to share information about potential threats. In addition, DHS's April 2008 Small Vessel Security Strategy emphasizes the importance of developing and

[6]73 Fed. Reg. 76295 (Dec. 16, 2008).

leveraging strong partnerships with the small-vessel community and public and private sectors to enhance MDA with respect to small vessels.

The Coast Guard has not coordinated the planning for the use of LRIT and commercially provided long-range AIS, resulting in potential duplication of information provided, but in coastal areas, inland waterways, and ports, the various tracking methods complement each other.

- Once fully operational, the two sources of offshore vessel identification and tracking information—LRIT and commercially provided long-range AIS—will largely duplicate each other both in terms of the vessels they can track and the information they provide. LRIT will be a global system, while commercially provided long-range AIS is intended to cover an area extending 2,000 nautical miles from U.S. shores. Both will report vessel location and name, although the use of commercially provided long-range AIS will provide additional information on speed, course, and cargo. However, for most vessels traveling to a U.S. port, most of this information is also available through the advance Notice of Arrival that vessels, other than U.S. registered recreational vessels, must typically provide the Coast Guard 96 hours prior to their arrival.[7] Coast Guard officials said they are planning to use commercially provided long-range AIS because it will provide another useful way to uncover anomalies in information received from offshore vessels.

- As of September 2008, the Coast Guard had not coordinated or analyzed the information LRIT and commercially provided long-range AIS can provide and the need for information from both. Coast Guard officials we spoke with said coordination of the development of the different vessel tracking systems to meet MDA should take place at an interagency level, rather than program, level. However, officials at the interagency body referred to by the Coast Guard—the Office of Global Maritime Situational Awareness—said that their role is to facilitate cross-government coordination of requirements and that they did not see coordination of programs within the Coast Guard as part of that role. The documents that currently act as the road map for MDA needs, the National Concept of Operations for Maritime Domain Awareness and National MDA Study Interagency Investment Strategy Document, do not mention any coordination in tracking system development.

[7]The Coast Guard requires that most vessels 300 gross tons or more notify the Coast Guard of their intent to call on a U.S. port and submit a broad range of information about the vessel and persons on board typically 96 hours prior to their entering port.

However, Coast Guard and Navy officials said that other federal agencies have vessel tracking needs and that a national strategy for AIS was being developed. Additionally, Coast Guard officials said that they plan to analyze the information they receive from the concept demonstration of commercially provided long-range AIS. However, they also said that they will not be able to determine the cost to utilize commercially provided long-range AIS data until it is more commonly available. While a certain amount of redundancy can be beneficial if it occurs by design, our previous work has found that unintended duplication indicates the potential for inefficiency and waste.[8]

- By contrast, while the development of multiple tracking systems—such as AIS, cameras, and radar—in coastal areas, inland waterways, and ports was not coordinated, the complementary capabilities of these different systems mean that one system may be able to address what the others cannot. For example, AIS tracks large commercial vessels, but cannot track vessels that are not AIS-equipped, such as noncommercial vessels that are not required to install AIS equipment. Cameras and radar provide some coverage of these vessels when they are installed in a port.

To ensure efficient and effective use of Coast Guard resources available for long-range vessel tracking, we are recommending that—upon completion of the commercially provided long-range AIS concept demonstration and the national AIS strategy, and after the cost of obtaining long-range AIS information from commercial providers becomes known—the Commandant of the Coast Guard determine the extent to which duplicate vessel tracking information from LRIT and commercially provided long-range AIS is needed to accomplish Coast Guard missions, particularly in light of information already available through national technical means.

We requested comments on a draft of this report from the Secretaries of Defense and Homeland Security and the Attorney General or their designees. DHS agreed with our recommendation. DHS further commented that, in addition to the cost and duplication concerns we expressed, the Coast Guard's review of the need for the two systems would also include factors such as the Coast Guard's statutory

[8]GAO, *Managing for Results: Using the Results Act to Address Mission Fragmentation and Program Overlap*, GAO/AIMD-97-146 (Washington, D.C.: Aug. 29, 1997).

requirements, risk assessments, MDA objectives, and the United States' obligations under international agreements.

DHS also said, however, that LRIT and commercially provided long-range AIS are two complementary systems that provide different information, apply to different classes and sizes of vessels, and are being developed and operated under separate statutory and international obligations. DHS commented that LRIT does not presently, nor will it when fully implemented, meet all the Coast Guard's requirements for identification and tracking of vessels either in navigable waters or off shore areas of the United States. While we acknowledge that as a stand-alone system, commercially provided long-range AIS is to provide more information on vessels traveling to the United States than LRIT, when the information from each is combined with other readily available sources, the information will be duplicative. Also, current rules for AIS and LRIT apply, in general, to similar classes and sizes of vessels. We agree that LRIT and the Coast Guard's use of commercially provided long-range AIS are being developed under separate statutory and international obligations, but the Coast Guard is not specifically required to use commercially provided long-range AIS under any U.S. law or international agreement.

Department of Homeland Security officials also provided technical comments on the draft that have been incorporated, as appropriate.

The Departments of Defense and Justice responded that they did not have any comments on the report.

Background

Maritime Domain Awareness: National Requirements

According to the Coast Guard, MDA is an effort to achieve an understanding of anything in the global maritime environment that can affect the security, safety, economy, or environment of the United States. The process of achieving MDA includes: (1) collection of information, (2) fusion of information from different sources, (3) analysis through the evaluation and interpretation of information, and (4) dissemination of information to decision makers, with the goal of identifying risks and threats before they turn into catastrophic events. One of the important tasks needed to achieve MDA is vessel tracking. Through the collection of vessel position information, comparison of that information with historical movements of the same and similar vessels, and additional information

related to the vessel—such as its ownership and history—the Coast Guard attempts to determine the degree of risk presented by each vessel.

Since the September 11, 2001, terrorist attacks, a number of improvements in maritime security and MDA have been provided for in three main statutory enactments.

- **MTSA**. MTSA provides for a wide range of security improvements to maritime systems, ports, and vessels. Among its provisions, MTSA requires the implementation of a system to collect, integrate, and analyze information concerning vessels operating on, or bound for, waters subject to the jurisdiction of the United States. To help meet this requirement, MTSA initially authorized the development and implementation of a long-range automated vessel tracking system for all vessels in U.S. waters equipped with a Global Maritime Distress and Safety System or equivalent satellite technology.[9] MTSA requires the system to be capable of receiving information on vessel positions at intervals appropriate to deter security incidents. MTSA further allows the use of existing maritime organizations, such as IMO, to collect and monitor tracking information under the system. In addition, MTSA requires that certain vessels, including commercial vessels over 65 feet in length, carry AIS technology that broadcasts information, such as the vessel's name, location, course, and speed while operating in U.S. waters.

- **Coast Guard and Maritime Transportation Act of 2004**. This act includes a provision that amended MTSA to mandate the development and implementation of the long-range automated vessel tracking system for all vessels in U.S. waters. The act also calls for the Secretary of Homeland Security to submit to specific congressional committees a plan that, among other things, (1) establishes a lead agency within DHS to coordinate the efforts of other agencies within DHS in the collection of maritime information and to identify and avoid unwanted redundancy of those efforts, (2) identifies redundancy in the collection and analysis of maritime information by agencies within DHS, and (3) establishes a timeline for incorporating information on vessel movements derived through the newly required long-range tracking

[9]Global Maritime Distress and Safety System equipment was already required by the IMO for many larger vessels and was originally intended to provide for automatic distress alerting and locating in cases where a radio operator does not have time to send an SOS or MAYDAY call.

system and AIS into the system for collecting and analyzing maritime information. DHS delivered this plan on June 28, 2005.

- **Security and Accountability For Every Port Act of 2006 (SAFE Port Act)**.[10] This act further amends the MTSA provisions for a long-range vessel tracking system. It sets a deadline of April 1, 2007, for the development of the tracking system. The SAFE Port Act also allows the Secretary of Homeland Security to establish a voluntary long-range vessel tracking system for the period before regulations are issued for the mandated system.

To help implement these laws, the Coast Guard has issued rules relating to both long-range tracking and AIS. In October 2007, the Coast Guard issued a proposed rule, entitled Long Range Identification and Tracking of Ships, and in April 2008 issued a final rule that requires certain vessels, including U.S.-registered vessels and foreign-registered vessels traveling to or from the United States, to report identifying and position data electronically through a long-range vessel tracking system.[11] These vessels consist of passenger vessels, including high-speed passenger craft; cargo vessels, including high-speed craft, of 300 gross tons or more; and mobile offshore drilling units while underway and not engaged in drilling operations. The Coast Guard also issued an interim rule in July 2003 and a final rule in October 2003 delineating AIS requirements. The vessels covered depend on whether they are on an international voyage or operating in a Vessel Traffic Service or Vessel Movement Reporting Service area. The requirements to carry and operate AIS equipment for vessels on international voyages generally apply to (1) all self-propelled vessels 65 feet or more in length, other than passenger and fishing vessels, engaged in commercial service; (2) passenger vessels of 150 gross tons or more; (3) tankers, regardless of tonnage; and (4) other vessels of 300 gross tons or more on international voyages. The requirements for vessels operating in Vessel Traffic Service or Vessel Movement Reporting Service areas generally cover self-propelled vessels engaged in commercial service of 65 feet or more in length, but do not include fishing vessels and passenger vessels certified to carry less than 151 passengers. However, towing vessels in commercial service that are 26 feet or more in length

[10]Pub. L. No. 109-347, 120 Stat. 1884 (2006).

[11]73 Fed. Reg. 23310 (Apr. 29, 2008).

with more than 600 horsepower engines and passenger vessels certificated to carry more than 150 passengers are also covered.

The Coast Guard issued a Notice of Proposed Rulemaking in December 2008 that would substantially change these requirements. If the final rule is implemented as proposed, more commercial vessels will be required to carry and operate AIS equipment in all navigable waterways of the United States. The vessels that are covered under the proposed rule include, (1) self-propelled vessels of 65 feet or more in commercial service, (2) towing vessels of 26 feet or more and more than 600 horsepower in commercial service, (3) self-propelled vessels carrying 50 or more passengers in commercial service, (4) vessels carrying more than 12 passengers for hire and capable of speeds greater than 30 knots, (5) certain dredges and floating plants, and (6) self-propelled vessels carrying certain dangerous cargos.

The Administration has also called for improvements to maritime security, primarily through Homeland Security Presidential Directive-13 (HSPD-13, also referred to as National Security Presidential Directive-41), issued on December 21, 2004. HSPD-13 directs the coordination of maritime security policy through the creation of a *National Strategy for Maritime Security*.[12] The directive required the Secretaries of Defense and Homeland Security to lead a joint effort to draft the strategy, which was issued in September 2005. Additionally, HSPD-13 directed relevant federal departments and agencies to develop eight supporting implementation plans to address the specific threats and challenges in the maritime environment. One of these supporting plans was the *National Plan to Achieve Maritime Domain Awareness*, developed by the Department of Defense and DHS and issued in October 2005. This plan provides an approach for improving information collection and sharing in the maritime domain to identify threats as early and as distant from U.S. shores as possible. For example, in terms of enhancing information collections, the plan calls for coordinating with international organizations to expand information requirements for data such as the Notice of Arrival. The plan also recommends expanding the application of AIS to improve the identification and tracking of marine vessels and leveraging national and

[12]For our evaluation of this strategy, see GAO, *Maritime Security: National Strategy and Supporting Plans Were Generally Well-Developed and Are Being Implemented*, GAO-08-672 (Washington, D.C.: June 20, 2008).

international commercial and governmental relationships to produce dependable AIS and other vessel tracking.

Maritime Domain Awareness: International Requirements

The IMO is an agency of the United Nations whose main task is to develop and maintain a comprehensive regulatory framework for shipping. Under its purview are vessel safety, environmental concerns, maritime legal matters, technical cooperation, and maritime security. Amendments to SOLAS, to which the United States is a party, contain two provisions that relate specifically to MDA.

Chapter V, Regulation 19-1, which generally became effective January 1, 2009, has phased-in implementation for vessels requires cargo vessels of 300 gross tons or more, passenger vessels, and self-propelled mobile offshore drilling units, to be equipped with technology enabling the automatic transmission of the identity of the vessel, its position, and the time and date the position was transmitted. The regulation also lays out what countries are authorized to receive this information and when. This SOLAS regulation is the basis for the Coast Guard's LRIT rule.

- IMO also set performance standards and functional requirements for LRIT in a resolution of its Maritime Safety Committee.[13] This resolution establishes the role of LRIT data centers and the international data exchange, which are central to the distribution of LRIT information. These data centers, which can represent a single country or multiple countries, have three primary roles.

- Data centers will forward LRIT information from vessels at sea to the international data exchange for transmission to authorized countries.

- When LRIT information is forwarded by the international data exchange to an authorized country, the data center representing that country receives the information.

- Data centers make requests for LRIT information through the international data exchange.

The international data exchange acts as a facilitator for the exchange of LRIT between vessels and countries. As discussed above, when a vessel

[13]Resolution MSC.210(81) (adopted on May 19, 2006).

transmits LRIT information to its data center, that data center will forward the information to the international data exchange. The international data exchange then forwards the vessel's LRIT information to the data centers representing the countries that are authorized to receive the LRIT information from that vessel.

Another regulation contained in SOLAS deals with AIS. In general, Chapter V, Regulation 19, requires certain vessels of 300 gross tons or more on international voyages, passenger vessels regardless of size, and cargo vessels of 500 gross tons or more not engaged on international voyages to be equipped with AIS. According to the regulation AIS shall provide information, such as identity and position, and monitor and track vessels.

Evolution of Long-Range Tracking Systems

The United States' history of using national technical means for remote tracking of vessels on the high seas goes back many years, but at the time Soviet warships—rather than commercial vessels—were the target of this tracking. Such means have been continually in place since that time, but their mission has grown from tracking potential military adversaries to tracking a wide variety of vessels, both military and nonmilitary, that are of interest to the United States. The actual vessels tracked are not necessarily limited by size.

Similarly, the capabilities of LRIT and AIS have been expanded as their purposes have changed. LRIT was primarily envisioned to utilize long-range technology to facilitate search and rescue operations and assist oceangoing vessels in distress. In order to respond to such an emergency at sea, the technology automatically transmits the identity, position, and time of position of a vessel in distress. To increase the likelihood of assistance to vessels in distress at sea, in 1988 IMO adopted phased-in requirements for vessels to install specific satellite and radio-telephone equipment capable of automatic distress alerting. The same equipment and technology can be used for LRIT; however, in addition to reporting information on vessels in distress, vessels would send periodic position reports that would permit them to be tracked by authorized governments.

AIS technology was originally designed to improve maritime safety, including the prevention of collisions among vessels. The system was originally designed to transmit identification, location, and maneuvering information (1) between vessels and (2) between vessels and land-based stations that are typically within 20 to 30 miles of one another. IMO requirements for the installation of AIS equipment include passenger

vessels irrespective of size, vessels that weigh 300 gross tons or more on international voyages, and cargo vessels of 500 gross tons or more not on international voyages. By using commercially provided long-range AIS, the Coast Guard hopes to greatly expand the distance it can receive AIS signals, up to 2,000 nautical miles from the coast.

Numerous Stakeholders Are Involved in Maritime Security and Maritime Domain Awareness

Although numerous entities are responsible for maritime security and MDA within the United States, the federal government has primary responsibility and shares this role with numerous other stakeholders in the state, local, and private sectors. For example, DHS—with its component agency, the U.S. Coast Guard, acting as executive agent—has the lead role in maritime homeland security, while the Department of Defense leads efforts to further integrate maritime intelligence and increase MDA. In addition, the Federal Bureau of Investigation has a lead role in investigating domestic maritime terrorism incidents. As shown in table 1, state and local governments and the private sector, as well as the federal government, have responsibilities for maritime security and domain awareness.

Table 1: Maritime Stakeholders and Their Roles in Maritime Security and Domain Awareness

Stakeholders	Selected mission-related activities
Federal government: Department of Homeland Security	
U.S. Coast Guard	• Conducts vessel escorts, boardings of selected vessels, and security patrols of key port areas. • Ensures vessels in U.S. waters comply with domestic and international maritime security standards. • Reviews U.S. vessel and facility security plans and oversees compliance with these plans. • Meets with foreign governments and visits foreign port facilities to observe security conditions. • Shares responsibility for implementation and operationalization of MDA with U.S. Navy.
Customs and Border Protection	• Has principal responsibility for inspecting cargo, including cargo containers that commercial vessels bring into U.S. ports. • Detects and prevents the illegal entry of persons and goods into the country.

Stakeholders	Selected mission-related activities
Federal government: Department of Defense	
U.S. Navy	• Provides support to Department of Homeland Security as requested for maritime homeland security operations. • Maintains a credible maritime interdiction capability to deal with identified hostile vessels at any location when authorized to do so. • Builds relationships with partner nations' navies to enhance cooperation and information sharing. • Shares responsibility for implementation and operationalization of MDA with U.S. Coast Guard.
Federal government: Department of Justice	
Federal Bureau of Investigation	• Federal Bureau of Investigation Maritime Liaison Agents, stationed at key ports in the U.S., help disseminate maritime intelligence to port stakeholders. • Leads Joint Terrorism Task Forces. • Leads investigations of maritime terrorism incidents.
State and local governments	
Law enforcement agencies	• Conducts land-based patrols of port facilities. • If the agency operates a marine unit, it typically conducts water patrols and sometimes escorts larger vessels.
Private sector	
Facility and commercial vessel operators	• Develops and implements facility or vessel security plans that meet MTSA standards. • Provides security for the facility or vessel.
The public	
General public, recreational vessel operators, and marina employees	• Reports suspicious activity. • Respects security rules regulations, such as those governing security zones.

Source: GAO.

Risk Management

The 9/11 Commission pointed out that no amount of money or effort can fully protect against every type of threat. Rather, a risk management approach is often used that considers, among other things, the relative risks various threats pose in determining how best to use limited resources to prevent threats, where possible, and to respond effectively if they occur. While the Homeland Security Act of 2002[14] and Homeland Security Presidential Directive 7 call for the use of risk management in homeland security, little specific federal guidance or direction exists as to how risk management should be implemented. In previous work examining risk management efforts for homeland security and other functions, we developed a framework summarizing the findings of

[14]Pub. L. No. 107-296, 116 Stat. 2135 (2002).

industry experts and best practices.[15] For tracking vessels, this effort requires identifying high-risk vessels as a priority and developing a layered system of security to reduce the risks associated with them. For example, the Coast Guard uses a risk management approach in its effort to determine which vessels bound for the United States may pose the greatest threat to the United States and which, given the limited resources available to the Coast Guard, should be boarded to determine if they pose an undue risk.

Multiple Systems Track Vessels at Sea and in U.S. Coastal Areas, Inland Waterways, and Ports, but Delays Could Affect the Implementation of Planned Systems with Greater Tracking Ability

The Coast Guard currently relies on a variety of systems to provide MDA and is also working on additional systems to provide additional capabilities, but these systems have been delayed by various factors. To track vessels at sea, the Coast Guard currently has access to data provided by national technical means with some limitations. However, the Coast Guard, as well as other federal agencies, has determined that it needs to expand its knowledge of vessel movements up to 2,000 nautical miles from the United States. To do so, the Coast Guard is leading the U.S. implementation of the IMO-mandated LRIT system and is pursuing the use of commercially provided long-range AIS capabilities. In U.S. coastal areas, inland waterways, and ports, the Coast Guard uses a network of land-based AIS and, in selected areas, additional sensors such as radar and video cameras.

To Track Vessels at Sea, the Coast Guard Is Planning to Use National Technical Means, LRIT, and Commercially Provided Long-Range AIS

To track vessels up to 2,000 nautical miles from U.S. shores, the Coast Guard is currently using classified national technical means and developing the use of two additional unclassified technologies—LRIT and commercially provided long-range AIS. Coast Guard officials told us that they cannot depend on full time access to information provided by national technical means. The Coast Guard does not control the tasking of these resources, and they may be redirected to priorities greater than

[15]For more detailed information on risk management and GAO's framework for risk management, see GAO, *Risk Management: Further Refinements Needed to Assess Risks and Prioritize Protective Measures at Ports and Other Critical Infrastructure*, GAO-06-91 (Washington, D.C.: Dec. 15, 2005), and *Highlights of a Forum Convened by the Comptroller General of the United States: Strengthening the Use of Risk Management Principles in Homeland Security*, GAO-08-627SP (Washington, D.C.: April 2008).

Coast Guard or DHS missions. While we cannot provide more details on national technical means because of their classified nature, the information below describes the Coast Guard's plans for LRIT and AIS.

To Ensure Its Widespread Use Domestically and Internationally, the Coast Guard Has Taken Substantial Responsibility for the International Implementation of LRIT

LRIT is an international system that uses onboard radio equipment to transmit identification and position information to satellites. From the satellites, the information is forwarded to ground stations and then on to recipient countries, including the United States. While the a system requires cooperation from the vessel—the radio equipment must be turned on—it is a closed system in that only countries with rights to the information can receive it.[16] The Coast Guard expects the LRIT program to cost approximately $5.3 million in fiscal year 2009 and about $4.2 million per year thereafter. See appendix I for a full description of LRIT.

The regulatory framework for the LRIT system is in place. As previously mentioned, the Coast Guard issued a final rule on April 29, 2008, setting requirements for many U.S.-registered vessels to transmit their identity and location with LRIT equipment wherever they are located. This rule implemented domestic requirements set forth in MTSA, as amended by both the Coast Guard and Maritime Transportation Act of 2004, and the SAFE Port Act; and IMO's international requirements laid out in SOLAS. As well as implementing requirements for most U.S vessels subject to the SOLAS regulation, the rule also sets specific requirements for foreign vessels traveling to or near the United States to broadcast their identification and location. For example, under the rule, foreign vessels bound for a U.S. port must transmit their identity and location once they have announced their intention to enter a U.S. port, typically 96 hours prior to their arrival (which equates to approximately 2,000 nautical miles from the U.S. coastline at speeds traveled by typical ocean-going vessels). It also calls for foreign vessels on international voyages to typically transmit their identity and location when they are within 1,000 nautical miles of the U.S. coast, even if they are not calling on a U.S. port. The

[16]As laid out by IMO in SOLAS, access to LRIT information varies by the country's relationship to the vessel or status as a flag, port, or coastal state. As a flag state, the contracting government may purchase LRIT information on a vessel anywhere in the world as long as the vessel is entitled to fly its flag. As a port state, a contracting government may purchase LRIT information on a vessel calling at its port after the vessel has indicated its intention to do so unless the vessel is within the internal waters of another contracting government. As a coastal state, the contracting government may purchase LRIT information on a vessel that is within a specified distance–not more than 1,000 nautical miles–off the coastal state's baseline unless the vessel is within its territorial sea or the internal waters of another contracting government.

requirements for both foreign and domestic vessels include the specific data items to be transmitted, the timetable for reporting, the types of equipment that can be used to report the information, and the capabilities of the reporting equipment. The rule has phased-in implementation dates beginning on December 31, 2008, depending on factors such as when a vessel was built and where it operates. The rule exempts certain vessels such as those that will be traveling exclusively within 20 nautical miles of the U.S. coastline and are equipped with operating AIS.

In addition to setting U.S. requirements for LRIT, the Coast Guard is also taking on international responsibilities to help ensure that LRIT position information is available on schedule. To ensure the appropriate distribution of LRIT information, the IMO mandated the creation of an international data exchange to facilitate the distribution of this information to authorized countries. For example, if a vessel registered in China is sailing to a U.S. port, the Chinese data center would have to begin to send the LRIT information to the U.S. data center through the international data exchange when the vessel announces it intention to enter a U.S. port. However, the mandate did not address which country or international organization would be responsible for developing, operating, and maintaining the international data exchange or how it would be funded. Because the United States and other SOLAS signatories were concerned that the data exchange would not be operational when the rule took effect, and because no other country had agreed to set up the exchange, the Coast Guard has agreed to develop and operate the data exchange for an interim period from January 1, 2009, to December 31, 2010. As of February 2009, it was unclear who would operate the international data exchange following this 2-year period.

Although the Coast Guard expected to begin receiving some countries' LRIT reports on schedule, it acknowledged that not all countries would be ready to participate. Coast Guard officials told us that the international data exchange and the U.S. national data center (the facility that will receive all LRIT transmissions from U.S.-registered vessels and forward them on to the data exchange) are operational. The Coast Guard also expected very few U.S.-registered vessels will need new equipment to transmit LRIT information because existing requirements already mandate the installation of radio equipment capable of the required transmissions. In contrast, the Coast Guard recognized that not all countries may have operational national or multinational data centers to forward information to the international data exchange by the time the rule goes into effect. The final rule states that the Coast Guard will still hold vessels coming to the United States responsible for providing LRIT information at that time.

If the Coast Guard does not receive LRIT information from a vessel covered by the rule, it has a range of enforcement options available. In general, the Coast Guard plans to leave the response up to their local Captains of the Port—the Coast Guard official responsible for maritime safety and security in a port area—to decide how to address these situations on a case-by-case basis. Under their regulatory authorities, these officials have the authority to, among other things, level civil penalties for noncompliance as well as refer knowing and willful violations to the Department of Justice for criminal prosecution. The Captain of the Port will make a risk-based decision given the information he or she has available from existing sources, and, depending on his or her finding, will decide on a response ranging from taking no action, boarding the vessel at sea, setting fines, or denying entry.

The Coast Guard Is Planning on Full Capability of Commercially Provided Long-Range AIS by 2014, Despite a 2-Year Delay

To have an additional means to receive vessel information that includes identification and location of vessels at sea, the Coast Guard is demonstrating another tracking system that uses commercially provided long-range AIS. AIS receivers take in a set of radio signals from equipment on board vessels and then forward them to the Coast Guard via the commercial provider. AIS is an open system, and anyone who has an AIS receiver can track vessels using AIS signals. See appendix II for a full description of AIS. The Coast Guard's use of commercially provided long-range AIS is part of the NAIS, a comprehensive effort to track AIS-equipped vessels[17] in U.S. coastal areas, inland waterways, and ports, and those as far as 2,000 nautical miles from the U.S. shore.

While the Coast Guard has made development of commercially provided long-range AIS a substantial part of its long-range vessel tracking efforts, the program has fallen behind schedule. In 2004, the Coast Guard signed a contract with a commercial communications company to demonstrate the ability of commercial AIS to receive and forward AIS broadcasts from vessels at sea. This demonstration was originally scheduled for mid-2006, but did not occur until June 19, 2008. Coast Guard officials said the delays were primarily caused by difficulties the contractor experienced in

[17]IMO requirements provide that all passenger vessels, regardless of size, all vessels of 300 gross tons and larger on international voyages, and all cargo vessels of 500 gross tons not on international voyages shall be fitted with AIS equipment. The Coast Guard refined these requirements to generally include commercial vessels 65 feet or longer, passenger vessels of 150 tons or more, and all tankers, either on international voyages or in Vessel Tracking Service areas.

obtaining needed services for the Coast Guard demonstration as well as technical issues.

As a concession for the delays, the contractor provided the Coast Guard access to vessel position data sent via AIS through other means. According to Coast Guard officials and to a filing made by the contractor to the Securities and Exchange Commission, terms of the contract state that once operational testing is completed, the Coast Guard will receive 90 days of AIS data to determine the characteristics of commercially provided long-range AIS, such as the amount of data that would flow from each source. The Coast Guard can also receive data from the concept demonstration for an additional 2 years, based on original contract options and pricing. If the Coast Guard wishes to continue to receive these data it will have to pay additional fees to the contractor.

In spite of the 2-year delay in the demonstration, the Coast Guard does not believe that its use of commercially provided long-range AIS will delay the full implementation of NAIS. Coast Guard officials stated that there were development issues related to using these AIS receivers that are different from those related to developing a land-based AIS network that will cover the U.S. coastline. According to the Coast Guard, the completion of its assessment of the commercially provided long-range AIS demonstration, including coverage areas, potential interference, and data rates, will allow it to compare commercially provided long-range AIS with other long-range tracking methods or, as they become available, among different commercial providers of long-range AIS services.

To Track Vessels in Coastal Areas, Inland Waterways, and Ports, Land-Based AIS Is the Primary National Tracking System but Other Systems Provide Coverage in Limited Areas

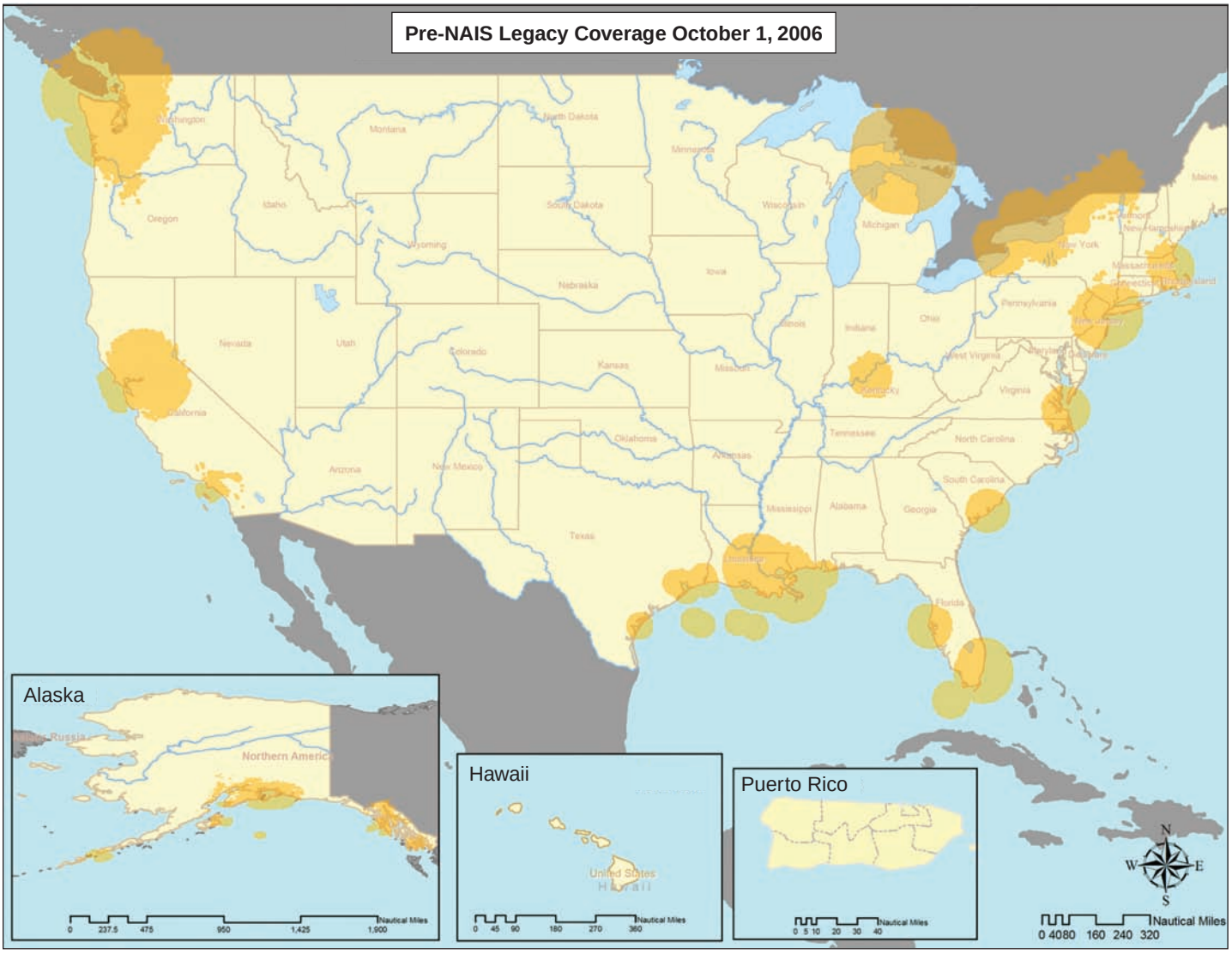
To track AIS-equipped vessels in 55 major U.S. ports and 9 coastal areas, the Coast Guard has installed a widespread network of ground-based AIS receivers it uses to monitor those areas. In some of these locations, the Coast Guard also makes use of radar and cameras, installed by the Coast Guard and other maritime security stakeholders, to help track vessels not equipped with AIS.

Coast Guard's Ground-Based AIS Is the Primary Means to Track AIS-Equipped Vessels in and around U.S. Ports

The Coast Guard installed ground-based AIS equipment in 55 ports and 9 coastal areas as the first increment of NAIS. Before Increment 1, AIS coverage in the United States was very limited. AIS-covered areas included Vessel Traffic Service and Vessel Movement Reporting Service areas, AIS prototyping and testing locations, and the St. Lawrence Seaway. This level of coverage, however, left out some major ports. As of September 2007, this first NAIS increment reached full operating capability, allowing near real-time tracking of vessels carrying and operating AIS equipment in all 55 covered ports and 9 coastal areas. In the coastal areas, the system generally provides coverage to within 24 nautical miles of shore. This tracking is performed by the local Coast Guard sector.

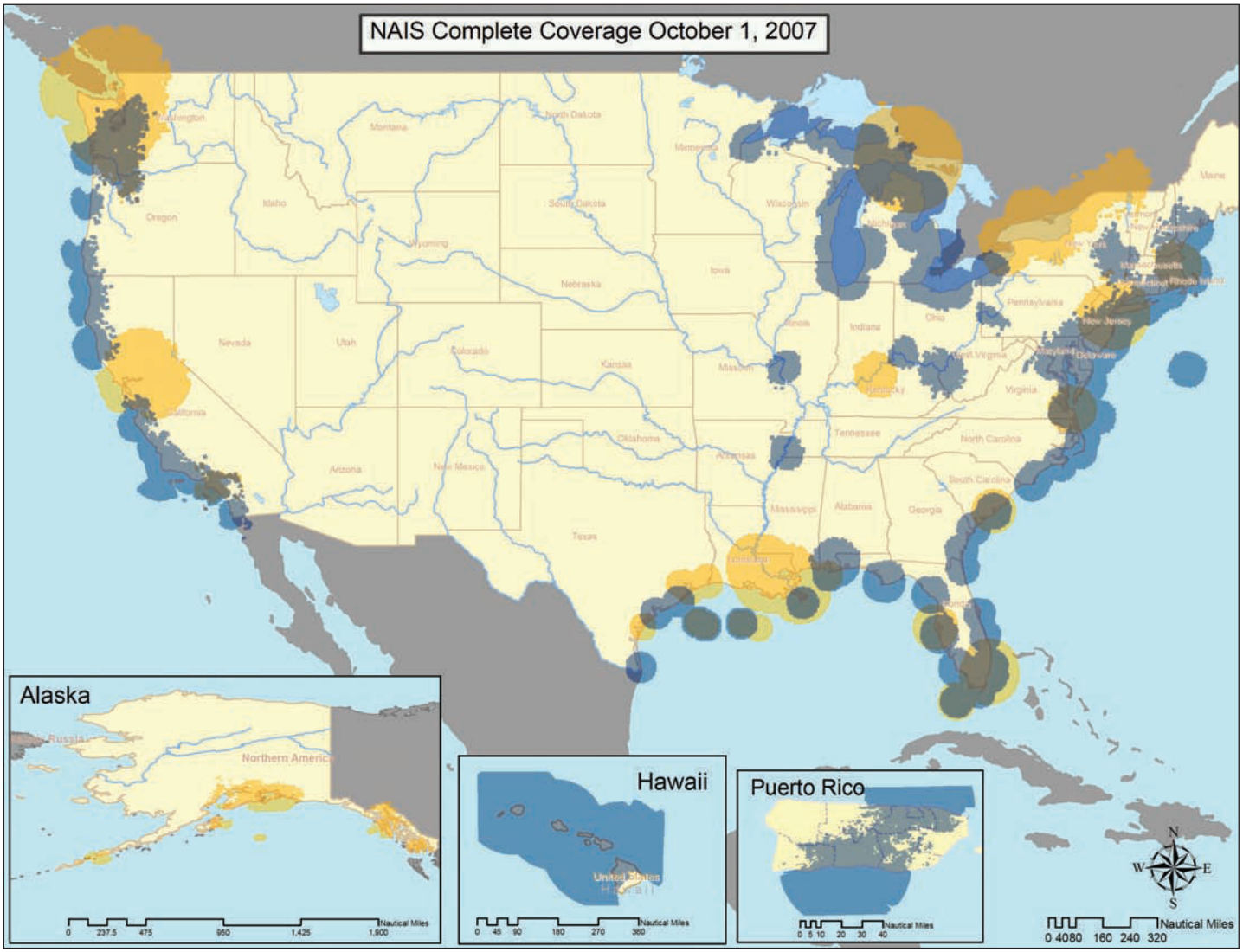
See figure 2 for a map of AIS coverage prior to NAIS Increment 1 and figure 3 for a map of AIS coverage after the implementation of NAIS Increment 1.

Figure 2: AIS Coverage Prior to Implementation of NAIS Increment 1



Source: U.S. Coast Guard.

Figure 3: AIS Coverage after Implementation of NAIS Increment 1



Source: U.S. Coast Guard.

Note: Coverage gaps between port coastal areas that exist that are not discernable in this figure due to its scale.

NAIS Increment 2 will further expand the coverage area of ground-based AIS. However there have been repeated delays in awarding the initial Increment 2 contract. Increment 2 is to provide the Coast Guard the capability to (1) receive AIS signals from up to 50 nautical miles from shore and (2) transmit information to vessels with AIS up to 24 nautical

miles from the U.S. coastline. Sensitive areas on inland rivers, such as locks and dams, will also be covered. The Coast Guard plans to implement Increment 2 in two phases. In the first phase, coverage will expand in the areas of responsibility for three Coast Guard field units—Sectors Delaware Bay, Hampton Roads, and Mobile. This will serve as a test for the expanded system. Once the capability of the system is established, the second phase will bring coverage to the rest of the United States. The Coast Guard, however, has repeatedly delayed the contracting process for Increment 2 to make modifications in the contract's Request for Proposal (RFP). After the release of draft contract solicitation documents for the first phase in December 2006, the expected release date of the final RFP was pushed back from July 2007 to November 2007, and the RFP was finally released in December 2007. The Coast Guard continued to make amendments to the RFP through February 2008 and the expected date to award the contract for the first phase of Increment 2 was delayed from March 2008 to September 2008.

While AIS is capable of tracking AIS-equipped vessels in many ports around the United States, as previously stated, many vessels in U.S. waters are not required to install or operate AIS equipment. According to Coast Guard regulations in effect on February 1, 2009, outside of the Vessel Traffic Service and Vessel Movement Reporting Service areas only vessels that arrive from a foreign port are required to operate AIS equipment, regardless of size or cargo. Outside of the Vessel Traffic Service and Vessel Movement Reporting Service areas, all vessels less than 65 feet in length and all noncommercial vessels less than 300 gross tons—except for tankers and certain passenger vessels—are never required to operate AIS equipment in U.S. waters. A Notice of Proposed Rulemaking issued by the Coast Guard in December 2008 demonstrates the Coast Guard's intention to expand these requirements.

The Coast Guard Can Track Vessels Not Equipped with AIS with Other Sensors in Some Ports

At 8 of the 10 sectors we visited, the Coast Guard can use additional sensors, such as radar and video cameras, to complement AIS. In 4 of the 8 sectors where these additional sensors are available, the local Coast Guard works directly with other port security stakeholders in the sector command center. For example, in some ports the Coast Guard has access to sensor feeds provided by the Navy. Similarly, in other ports, the Coast Guard has access to cameras installed by local governments and private industry. These were installed to monitor conditions at specific locations such as bridge abutments or entrances to secure facilities. Other Coast Guard locations are far less equipped. In some ports, local Coast Guard units are dependent solely on AIS technology to track vessels.

Existing and Planned Technology Can Track Most Larger Vessels at Sea, but Tracking of Smaller Vessels in U.S. Coastal Areas, Inland Waterways, and Ports Is Often Limited and May Present Challenges in Preventing an Attack

The three primary means for vessel tracking at sea are proven technologies and can track most larger vessels sailing to the United States. Two of these systems, however, are dependent on cooperation on the part of vessel operators. In U.S. coastal areas, inland waterways, and ports, AIS, the primary means of tracking AIS-equipped vessels is capable of detecting only a fraction of vessels operating in these locations. Other means, such as radar and video cameras, can enhance tracking to a degree. However, even if multiple systems are in place for tracking vessels in U.S. coastal areas, inland waterways, and ports, tracking small vessels such as potential suicide attack boats is difficult.

At Sea, Where Most Vessels Are Larger and Equipped with AIS or Other Radio-Based Equipment, Tracking and Response Can Be Effective, but Tracking Systems Have Limitations

As long as vessel operators comply with international and U.S. requirements to properly operate LRIT and AIS equipment, these systems should be able to accurately track vessel movements up to 2,000 nautical miles from the U.S. coastline. Given the distance from the U.S. coastline that such vessels will first begin to be tracked, the Coast Guard and the Navy have approximately 4 days to investigate and respond to potential vessel-borne threats. When vessel operators do not comply with requirements, the Coast Guard can use national technical means.

National Technical Means Can Support the Coast Guard in Meeting Its MDA Goals

National technical means have been used by the United States to track vessels at sea for many years. We cannot, however, discuss the technology these means use. These assets are available to the Coast Guard and can be used to increase MDA. In April 2007, for example, the Commandant of the Coast Guard announced that it was meeting the SAFE Port Act mandate to track all large commercial vessels within U.S. waters, using, in part, classified information. However, information gathered through the use of national technical means cannot usually be shared with other government agencies and port partners, which, according to the Coast Guard, may complicate a multiagency response to a potential threat.

LRIT Is a Proven Technology for Tracking Vessels at Sea

The effectiveness of Global Maritime Distress and Safety System-based LRIT to track vessels at sea has already been demonstrated. According to officials from MISNA, their organization has satellite-based tracking

capability that it has used to track vessels at sea, including the North Pacific and off the coast of Alaska. Using in part the on-board Global Maritime Distress and Safety System equipment, available software, and organizational infrastructure and databases, MISNA has provided information to the Coast Guard for tracking vessels at sea and aiding MDA. Since it became operational, the Global Maritime Distress and Safety System has, as originally envisioned, provided position information and communications capability to search and rescue efforts for vessels in distress.

The Global Maritime Distress and Safety System coverage includes most of the earth with the exception of the polar regions. This is not an issue in the Southern Hemisphere because the area without satellite coverage is on land. In the Northern Hemisphere, however, some areas, including parts of the Arctic Ocean north of the Canadian mainland, around the Canadian Arctic Archipelago, and north of the Russian mainland that are at least seasonally navigable are out of range of the satellites.

The Coast Guard's final rule requires vessels to broadcast their identification and position information every 6 hours, but the Coast Guard can obtain information on their position more frequently. This rule is based on IMO's standards for LRIT. Again, the Coast Guard rule requires, and IMO's standards direct, that installed LRIT equipment automatically respond to a remote request for a position report. This allows the Coast Guard to establish the location of vessels coming to the United States at least every 6 hours. A Coast Guard official said the system will be capable of handling such polling up to four times per hour per vessel.

While shipboard LRIT equipment must be able to transmit position information, as discussed earlier in this report, the Coast Guard's ability to receive it depends on the establishment of national or multinational data centers which serve as information conduits between the vessels and the international data exchange. If, for example, a foreign-registered vessel was sailing to the United States and the nation registering that vessel had not either established or participated in an LRIT data center, there would be no approved way for that vessel to transmit its position report to the international data exchange and then on to the Coast Guard. As of August 27, 2008, seven countries are participating in data center prototype testing and the Coast Guard reported that four additional countries have requested to commence testing of their centers.

Commercially Provided Long-Range AIS Is in Early Stages of Development

While the Coast Guard is working toward a solution that will provide AIS coverage for certain vessels at sea up to 2,000 nautical miles from the U.S. coastline, its efforts are in the initial stages.

The extent of the commercial system needed to provide long-range AIS data and its costs are unclear. Coast Guard officials are uncertain about how much commercially provided long-range equipment they will need because they are still developing the operational objectives for the system. For example, Coast Guard officials said the ability of the equipment to provide the data as frequently as desired depends to some extent on the how much equipment is in place. The greater amount in place, the greater the probability of receiving the AIS data once every hour—but the Coast Guard is not yet ready to commit to a specific amount. Coast Guard officials said the price of the data set by the provider will help them determine the amount of data they are willing to contract for. Further, Coast Guard officials said they may not necessarily adopt the system currently being considered if the results from the system's demonstration and tests are not promising. They said there are other companies and equipment they plan to consider as they determine the best means to meet their offshore AIS needs.

Tracking with LRIT and Commercially Provided Long-Range AIS Depends on Vessel Operator Compliance and Correctly Operating Equipment

The major systems the Coast Guard envisioned for tracking vessels at sea depend on the compliance of vessel operators. Both LRIT and AIS equipment onboard vessels can be easily turned off if the vessel operator does not want to be tracked. IMO requirements even allow both types of equipment to be turned off in certain conditions, such as when the vessel's master believes the operation of the LRIT equipment will compromise the vessel's safety or security.[18] If the equipment is turned off, such vessels will be invisible to these systems. Additionally, for AIS, some information that is transmitted must be programmed by the vessel operator. If that information is improperly programmed, either intentionally or not, the Coast Guard will not receive accurate information about the vessel. This has already happened with shore-based AIS. According to Coast Guard officials, in these cases, some AIS users were not updating their equipment to accurately reflect voyage-related information such as destination and estimated time of arrival. Further, the Coast Guard had encountered AIS equipment that either did not transmit at all or improperly transmitted the

[18]For example, a vessel's master is allowed to turn off the vessel's AIS equipment while it is sailing in waters known to be frequented by pirates. Since AIS is an open system, pirates can use AIS signals to track their targets.

vessel's dynamic data, such as position, course, speed, and heading. While the causes of the problems were not clear, the Coast Guard noted that such problems could have been due to lack of diligence on the part of the vessel operator, improper installation, or problems with the operation of external sensors with input into the AIS.

A Wider Variety of Tracking Systems Are Used in Coastal Areas, Inland Waterways, and Ports, but Providing Needed Information in Time to Stop an Attack Is Difficult

While tracking systems for coastal areas, inland waterways, and ports are more fully developed, preventing attacks can prove difficult in spite of effective tracking systems.

AIS Is a Proven Mechanism That Can Track Vessels with Necessary Equipment Properly Installed and Operating

AIS technology relies upon proven global positioning systems, shipboard sensors, and radio communication equipment that allow the exchange of navigation information between vessels and shore-side receiving stations. The ability to track vessels has been demonstrated since its earliest installations. For example, the Saint Lawrence Seaway Development Corporation and the Canadian St. Lawrence Seaway Management Corporation implemented a comprehensive vessel communications and tracking network to identify and track all commercial vessels navigating on the seaway. This system included the first fully operational AIS network in North America and enabled automatic vessel position reporting from vessels equipped with AIS transponders from Montreal to eastern Lake Erie.

While AIS can track vessels with installed and operating equipment, many vessels that are common in coastal areas, inland waterways, and ports are not currently required by current U.S. laws or regulations to operate AIS equipment. These vessels include

- most vessels not in commercial service, including recreational boats,
- most fishing vessels,
- most commercial vessels less than 65 feet long, and

- vessels not on international voyages and not navigating designated Vessel Traffic Service or Vessel Movement Reporting Service areas.[19]

The proposed rule issued by the Coast Guard would substantially expand the types of vessels required to use AIS equipment and the locations where the operation of AIS equipment is required in the United States. The proposed rule would require the following types of vessels install and operate AIS: (1) self-propelled vessels of 65 feet or more in commercial service, (2) towing vessels of 26 feet or more and more than 600 horsepower in commercial service, (3) self-propelled vessels carrying 50 or more passengers in commercial service, (4) vessels carrying more than 12 passengers for hire and capable of speeds greater than 30 knots, (5) certain dredges and floating plants, and (6) self-propelled vessels carrying certain dangerous cargos. A major change included in this proposed rule was the inclusion of commercial fishing vessels that were not previously required to carry AIS equipment. Most noncommercial vessels, such as small recreational speed boats are not covered under the proposed rule. Besides adding new classes of vessels under AIS requirements, the geographic areas covered would also be greatly expanded. Under the proposed rule the specified vessel categories would have to operate AIS on all United States navigable waters.

Radar and Cameras in Ports Have Their Own Limitations

Radar and video cameras are used in some ports to detect the many vessels that are not required to operate AIS equipment, but these sensors have their own limitations. Radar is an effective means to track many vessels, but has difficulty detecting smaller vessels. Given their size, small vessels do not produce strong radar reflections. Also, waves can produce reflections that may be mistaken for vessels. In addition, if a large vessel sails between radar and a smaller vessel, the smaller vessel may be masked from detection. Finally, radar, unlike AIS, has no ability to identify a vessel. Different types of video cameras have also been installed in ports, and each has its own advantages and disadvantages. Some cameras have the capability to move and follow targets and zoom in to get a more magnified view of the target. Other cameras are fixed in place to cover specific locations, such as specific facilities or bridge abutments, and can

[19]The following vessels navigating in Vessel Traffic Service or Vessel Movement Reporting Service areas are required to operate AIS equipment: commercial vessels 65 feet or more in length except for fishing boats or passenger vessels certified to carry less than 150 persons, commercial towing vessels 26 feet or more in length and more than 600 horsepower, and passenger vessels certified to carry more than 150 passengers for hire.

only see vessels as they pass within the line of sight of the camera. Other installed cameras cannot zoom. Certain cameras, such as some in place in one port, also have the ability to operate in low light or use infrared images that distinguish objects by the heat they emanate. These capabilities allow them to be effective when cameras using visible light prove ineffective, such as at night or in bad weather. These, however, can still be affected by atmospheric or surf conditions.

Even with All Sensors in Place, the Coast Guard May Be Challenged in Preventing Attacks without Prior Knowledge

In studies we reviewed and discussions with maritime stakeholders, there was widespread agreement that detecting threatening activity by vessels is very difficult without prior knowledge. See figure 4 for small vessels operating in main shipping lanes of New York harbor.

Figure 4: Small Vessels Operating among Large Commercial Vessels

Source: Sandy Hook Pilots.

The Coast Guard is trying to develop means to detect suspicious behaviors that do not require human input. For example, the Coast Guard is testing software in one port to develop the ability to determine suspicious behavior without human intervention. Sensors would be monitored by software that learns the expected activity of the port and would sound an alarm when unexpected activity occurs. According to Coast Guard

officials, it takes years for the software to learn the normal behavior at the port.

The Coast Guard and Other Stakeholders Rely on Relationships to Increase Their Awareness of Activities on the Water, and DHS Has Developed a Small Vessel Security Strategy That Emphasizes the Importance of These Relationships

In part to help obtain this intelligence and expand their awareness of activities on the water, the Coast Guard and other port security stakeholders have engaged in outreach efforts with the port community. All of the Coast Guard locations we visited had long-standing relationships with local professional mariners, such as pilots and tug operators. The Coast Guard officials we spoke with thought these relationships were beneficial in enhancing MDA. For example, several Delaware River Pilots alerted Sector Delaware Bay of two small armed vessels traveling at high speed from the Chesapeake and Delaware Canal into the Delaware River. Coast Guard boats responded to these craft on the basis of this information, and the suspect craft turned out to be Navy Seals on an unannounced exercise, but the pilots provided the only notice to the Coast Guard. The Coast Guard has also implemented a nationwide program called America's Waterways Watch to engage all those who work, live, or recreate on or near the water to be aware and report suspicious activity that may indicate possible threats. This type of effort is a major recommendation in the DHS Small Vessel Security Strategy. The strategy considers the small vessel community as the single largest asset in addressing the threat from small boat attacks. Coast Guard sectors have also developed information-sharing agreements with state, local, and law enforcement agencies that are intended to increase awareness and cooperation. Some state and local outreach efforts are especially active. For example, the New Jersey State Police's program, the Maritime Security Initiative, follows the America's Waterways Watch model, but goes even further. State Police officers make regular—sometimes weekly—proactive visits to locations such as marinas, boat ramps, and waterfront properties to ask individuals in these areas about any suspicious or out of place behavior they may have witnessed. See figure 5 for brochures on state and federal outreach efforts.

Figure 5: Brochures for New Jersey State Police's Maritime Security Initiative and Coast Guard's America's Waterways Watch Outreach Efforts

Sources: New Jersey State Police; U.S. Coast Guard.

Long-Range Tracking Systems Are Potentially Duplicative, While Systems for Vessel Tracking in U.S. Coastal Areas, Inland Waterways, and Ports Provide Complementary Information That Covers Additional Vessels

While current plans for vessel tracking systems lead to potential duplication in vessels tracked and information received, systems that track vessels in coastal areas, inland waterways, and ports are complementary in that they track different types of vessels and vary in their capabilities. The long range systems—LRIT, commercially provided long-range AIS, and national technical means—were initially developed independently of each other and for different purposes, but the Coast Guard was unable to provide evidence that the planning for the current and future use of LRIT and commercially provided long-range AIS was coordinated. Furthermore, the Coast Guard has yet to consider the costs and benefits of obtaining offshore vessel identification and tracking information from the multiple sources currently, or soon to be, available to the Coast Guard. In coastal areas, inland waterways, and ports, there are greater differences among the tracking systems. AIS provides extensive information but its use is limited to larger vessels while radar and video cameras, sensors that are located in some ports, provide limited information but can pick up varied vessels. Additionally, cameras can be affected by environmental conditions, unlike AIS and radar.

Plans for Use of Commercially Provided Long-Range AIS and LRIT Were Not Coordinated

Despite the likelihood that the multiple sources of offshore vessel identification and tracking information would produce duplicative information, the Coast Guard was unable to provide evidence that its efforts to obtain this information were coordinated. Coast Guard officials we spoke with said the coordination of the development of LRIT and NAIS should take place not at the Coast Guard, but at an interagency level. When we met with officials at one of the interagency bodies with a role in MDA mentioned by the Coast Guard officials—the Office of Global Maritime Situational Awareness—they said that their role is to facilitate cross government coordination of requirements and that they did not see coordination of programs within the Coast Guard as part of that role. The documents that are the planning guides for MDA, the National Concept of Operations for Maritime Domain Awareness and National MDA Study Interagency Investment Strategy Document do not mention any coordination being done in tracking system development or why both systems are necessary. Similarly, the plan DHS developed in response to the requirement in the Coast Guard and Maritime Transportation Act of 2004 for a plan to address unwanted redundancy in the collection and analysis of maritime information by agencies within DHS did not address coordination of the two systems or the need for both. In addition, while NAIS was regularly mentioned in the issues of the MDA Director's Newsletter we obtained, no mention was made of LRIT. In the Maritime

Domain Awareness Business Plan, Year End Summary for April 2006 to May 2007, NAIS and LRIT are listed as separate projects, and there is no mention of commercially provided long-range AIS. Similarly, the Coast Guard did not analyze the costs and benefits of using multiple sources to obtain similar information. Coast Guard officials said that when they complete their assessment of the results of the commercially provided long-range AIS demonstration they will be able to compare its capabilities to other long-range tracking capabilities. However, they also said that they will not be able to determine the cost for commercially provided long-range AIS data until more AIS-equipped commercial equipment is available. In the meantime, according to Navy and Coast Guard officials, there is a growing awareness of the need for offshore vessel identification and tracking among other agencies of the federal government, such as the Navy and DHS's Office of Customs and Border Protection. In recognition of this need, these officials said the federal government is developing a national strategy for AIS. While a certain amount of redundancy can be beneficial if it occurs by design, as part of a management strategy, our previous work has found that unintended duplication indicates the potential for inefficiency and waste.[20] In addition, our prior work at DOD has shown that the absence of an integrated management approach can contribute to duplication in programs and equipment that do not operate effectively together.[21]

Other Data Sources Are Available to Provide Commercially Provided Long-Range AIS's Expanded Information

As a stand-alone system, commercially provided long-range AIS is to provide more information on vessels traveling to the United States than LRIT, but when the information from each is combined with other readily available sources, the information will be duplicative. Current plans have both commercially provided long-range AIS and LRIT providing information about vessels bound for a U.S. destination at 2000 nautical miles from the U.S. coastline. At approximately this location, vessels bound for the United States are typically required to send an advance Notice of Arrival to the Coast Guard, providing detailed information about the vessel, its voyage, its cargo, and its crew. When AIS or LRIT information is combined with the information provided in the Notice of Arrival, the Coast Guard will have available much the same information

[20]GAO/AIMD-97-146.

[21]GAO, *Best Practices: An Integrated Portfolio Management Approach to Weapon System Investments Could Improve DOD's Acquisition Outcomes*, GAO-07-388 (Washington, D.C.: Mar. 30, 2007).

regardless of whether it is using commercially provided long-range AIS or LRIT to track a vessel. (See table 2.)

Table 2: Information to Be Provided by Two Planned Long-Range Vessel Tracking Systems Combined with Information Provided by Notices of Arrival for Vessels Traveling to a U.S. Port

	AIS with Notice of Arrival	LRIT with Notice of Arrival
Static information: information that rarely changes over the operational life of the vessel	Vessel name[a]	Vessel name[b]
	Identification numbers[a]	Identification numbers[b]
	Radio call sign[a, c]	Radio call sign[c]
	Vessel type[a]	
	Vessel dimensions[a]	
	Name of registered owner[c]	Name of registered owner[c]
	Name of operator[c]	Name of operator[c]
	Country of registration[c]	Country of registration[c]
Voyage-specific information: information that changes with each sailing	Port destination in U.S[a, c]	Port Destination in U.S[c]
	Specific facility and port destination in U.S.[c]	Specific port and facility destination in U.S.[c]
	Estimated time of arrival[a, c]	Estimated time of arrival[c]
	Estimated time of departure[c]	Estimated time of departure[c]
	Cargo type[a, c]	Cargo type[c]
	Name and date of last five ports visited[c]	Name and date of last five ports visited[c]
	Name, date of birth, nationality, and passport number of everyone on board[c]	Name, date of birth, nationality, and passport number of everyone on board[c]
Dynamic information: information that changes continuously	Location[a]	Location[b]
	Course[a]	
	Speed[a]	
	Rate of turn[a]	

Source: GAO analysis.

[a]Information supplied through AIS signals.

[b]Information provided through LRIT signals.

[c]Information supplied by the Notice of Arrival.

Other characteristics of the two planned systems vary. Ordinarily, commercially provided long-range AIS will transmit information much more often (from every 2 seconds to every 6 minutes depending on the information) than LRIT (every 6 hours). However, if the Coast Guard needs location information more frequently, LRIT will allow it to remotely

poll inbound vessels and receive an automatic reply for location reports up to every 15 minutes. However, since vessels are being tracked while they are several days from port, the Coast Guard is unlikely to need this information more frequently. Additionally, while the vessel transmitters for both tracking systems can be turned off by the crew, Coast Guard officials we spoke with said it is easier to change the programming of onboard AIS equipment to transmit false position reports than it is for LRIT.

Although the Coast Guard says it wants both commercially provided long-range AIS and LRIT to detect anomalies, such as vessels broadcasting false position reports or not broadcasting position reports at all, the Coast Guard has other sources to corroborate such information. For example, the Coast Guard can use national technical means along with either LRIT or NAIS to detect anomalies. While the capabilities and information provided by national technical means are classified, the Coast Guard is able to obtain important benefits from the use of these means. According to the Coast Guard, to obtain the full benefit provided by national technical means, Coast Guard analysts track that information over time and combine it with information provided by other sources, such as Notices of Arrival and commercial reporting. Through analysis of the information available from national technical means, the Coast Guard should be able to provide sufficient information to verify the identification and location of vessels provided through LRIT or commercially provided long-range AIS.

Complementary Capabilities of Systems in Coastal Areas, Inland Waterways, and Ports Provide the Potential That Vessels Missed by One System Can Be Picked Up by Others

As explained earlier in this report, each system in place in coastal areas, inland waterways, and ports has limitations, but these limitations can be mitigated with different sensors. In locations where all these sensors are available, their complementary nature allows for almost a complete picture of the port and surrounding area. For example, in one port, Navy, and local agencies have installed a wide array of sensors that cover 90 percent of the port and much of the coastal area. There, radar can detect larger noncommercial vessels that do not carry AIS. Cameras that can operate in daylight, dusk, and at night can follow smaller vessels that do not carry AIS and are difficult to pick up on radar. For vessels that do carry AIS equipment, the land-based AIS receivers can provide a wide range of information that neither radar nor cameras can. As stated earlier in this report, we saw similar capabilities in other locations where the Coast Guard worked directly with other maritime security stakeholders to track vessels in ports and multiple sensors were installed. While the presence of multiple sensors allows this broad coverage, these sensors are

only available where other agencies have installed them. In other locations, few sensors beyond AIS are available. In these locations, tracking is limited to those vessels transmitting via AIS equipment.

Conclusions

Threats to the maritime transportation system include the use of large merchant vessels to transport weapons of mass destruction; explosive laden suicide boats as weapons; and vessels to smuggle people, drugs, weapons, and other contraband. The importance and vulnerabilities of the maritime transportation system require that efforts be made to reduce the risk of a terrorist attack. The Coast Guard has acknowledged that it needs to close the gaps in maritime security, including long-range tracking of vessels and threats presented by small vessels. Knowledge of activities, such as vessel movements that take place within the system, is vital to reducing the vulnerability of the maritime transportation system. Classified national technical means to do so have been operational for many years and LRIT—a statutorily required long-range tracking system—is now available to the Coast Guard to monitor the movements of larger commercial vessels at sea. Along with the Notice of Arrival, these systems provide a complete picture of larger commercial vessel movements and other pertinent information. Furthermore, these three sources of information provide the necessary overlap for the Coast Guard to be able to detect anomalies. In the longer term, the Coast Guard is also planning on obtaining offshore vessel identification and tracking information through commercially provided long-range AIS, which, according to Coast Guard plans, will not be fully operational until 2014, at an unknown final cost. At this point, the Coast Guard has not determined whether the concept will work as planned. However, beyond the Coast Guard, some other federal agencies may have a need for commercially provided long-range AIS and a national strategy for the use of commercially provided long-range AIS is to consider these needs. Still, the Coast Guard has not coordinated its programs to obtain offshore vessel-tracking information or analyzed the costs and benefits of using the multiple sources. As a result, the Coast Guard could potentially invest its limited resources to procure additional information that may not be necessary for its MDA mission. Given the limited resources available, the Coast Guard needs to determine how to best spend those resources for offshore vessel identification and tracking.

Recommendation for Executive Action

To ensure efficient and effective use of Coast Guard resources available for long-range vessel tracking, we recommend that—upon completion of the commercially provided long-range AIS concept demonstration and the national AIS strategy and after the cost of commercially provided long-range AIS information becomes known —the Commandant of the Coast Guard determine the extent to which duplicate vessel-tracking information from LRIT and commercially provided long-range AIS is needed to accomplish Coast Guard missions, particularly in light of information already available through national technical means.

Agency Comments and Our Evaluation

We provided a draft of this report to the Departments of Homeland Security, Defense, and Justice for their review and comment. The Departments of Defense and Justice responded that they did not have any comments on the report. In an October 31, 2008, letter, the Department of Homeland Security provided written comments, which are summarized below. However, we were unable to include the full text of the written comments in this report because they contain sensitive information.

DHS agreed with our recommendation that—upon completion of the commercially provided long-range AIS concept demonstration and the national AIS strategy and after the cost of commercially provided long-range AIS information becomes known—the Commandant of the Coast Guard determine the extent to which duplicate vessel-tracking information from LRIT and commercially provided long-range AIS is needed to accomplish Coast Guard missions, particularly in light of information already available through national technical means. Further, DHS commented that, in addition to the cost and duplication concerns we expressed, the Coast Guard's review of the need for the two systems would also include factors such as the Coast Guard's statutory requirements, risk assessments, Maritime Domain Awareness objectives, and the United States' obligations under international agreements.

DHS also said, however, that LRIT and commercially provided long-range AIS are two complementary systems that provide different information, apply to different classes and sizes of vessels, and are being developed and operated under separate statutory and international obligations. Furthermore, DHS commented that LRIT does not presently, nor will it when fully implemented, meet all the Coast Guard's requirements for identification and tracking of vessels either in navigable waters or off shore areas of the United States. While we acknowledge that as a stand-alone system, commercially provided long-range AIS is to provide more information on vessels traveling to the United States than LRIT, when the

information from each is combined with other readily available sources, the information will be duplicative. For example, at approximately 2,000 nautical miles from the U.S. coastline—the same distance at which AIS and LRIT will provide information about vessels bound for a U.S. destination—vessels are typically required to send an advance Notice of Arrival to the Coast Guard providing detailed information about the vessel, its voyage, its cargo, and its crew. When AIS or LRIT information is combined with this information, the Coast Guard will have available much the same information regardless of whether it is using commercially provided long-range AIS or LRIT to track a vessel. Furthermore, current rules for AIS and LRIT apply, in general, to similar classes and sizes of vessels. For example, under SOLAS, AIS covers larger commercial vessels, such as those 300 gross tons or more on international voyages, cargo vessels 500 gross tons or more not on international voyages, and passenger vessels regardless of size. LRIT regulations in SOLAS apply to cargo vessels of 300 gross tons or more, as well as to passenger ships and mobile offshore drilling rigs. We agree that LRIT and commercially provided long-range AIS are being developed under separate statutory and international obligations. However, the Coast Guard is not specifically required to implement commercially provided long-range AIS under any U.S. law or international agreement. In addition, we did not find evidence that the Coast Guard had gone through a deliberative process to identify requirements and determine the optimal assets or asset mix to meet them.

Department of Homeland Security officials also provided technical comments on the draft that have been incorporated, as appropriate.

As arranged with your offices we plan no further distribution until 30 days after the date of this report. At that time, we will send copies of this report to the Secretaries of Defense, Homeland Security, and Justice; and other interested parties. In addition, the report will be available on GAO's Web site at http://www.gao.gov.

If you or your staff have any questions about this report, please contact me at (202) 512-9610 or caldwells@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. Key contributors to this report are listed in appendix III.

Stephen L. Caldwell
Director, Homeland Security and Justice Issues

Appendix I: Long-Range Identification and Tracking (LRIT)

This appendix provides additional information on long-range identification and tracking (LRIT). In 2002, the Maritime Transportation Security Act authorized the Secretary of Homeland Security to develop and implement an automated long-range identification and tracking program for certain vessels in U.S. waters.[1] In turn, the Secretary delegated the authority to the Coast Guard which subsequently pursued the implementation of such a system with International Maritime Organization (IMO) to achieve the full benefits of LRIT. From 2002 to 2006, the Coast Guard worked with IMO to establish a legal mechanism whereby governments can access vessel position information while on international voyages. A 2006 amendment to the International Convention for the Safety of Life at Sea, 1974 (SOLAS) required vessels on international travel to report their identity, position, and the date and time of the report, which are collectively called LRIT information. The amendment applies to passenger vessels carrying more than 12 passengers, cargo vessels of 300 tons or more and self-propelled mobile offshore drilling units.

The LRIT system primarily consists of the vessel-borne equipment,[2] maritime communication satellites, satellite ground stations, LRIT data centers, and an international data exchange. The vessel-borne equipment consists of radio equipment capable meeting the following requirements:

- transmitting and receiving data information to and from maritime communication satellites,
- obtaining vessel position information from onboard global navigation satellite system equipment or its own internal positioning capability,
- automatically transmitting the vessel's LRIT information at 6-hour intervals to an LRIT data center,
- being remotely configured to transmit LRIT information at variable intervals up to every 15 minutes, and
- transmitting LRIT information upon request.

[1]These vessels include all those that are equipped with the Global Maritime Distress and Safety System, which includes vessel-borne equipment and the International Maritime Satellite (INMARSAT-C) or equivalent satellite technology.

[2]According to the Coast Guard, Global Maritime Distress and Safety System equipment that is already onboard U.S. vessels due to preexisting SOLAS requirements meets the IMO performance standards for transmitting the required LRIT data.

The LRIT information from a vessel (vessel identity and position) is picked up by the satellites, retransmitted to the ground stations, and routed to a data center that serves the country where the vessel is registered. LRIT data centers are the conduits for LRIT information to and from vessels at sea. They can serve individual countries, regional groups of countries, or a broad collection of various countries. For example, the United States will operate its own data center and LRIT information from U.S. registered vessels will be routed to the U.S. data center. Requests from nations for more frequent position information from U.S. vessels are also made to the U.S. data center. After receiving LRIT information from a vessel, the data center sends it to the international data exchange. The international data exchange is the clearinghouse for LRIT information and distributes the information to data centers serving countries entitled to receive the information. To continue the previous example, the U.S. data center sends the position and identification information from the U.S. vessel to the international data exchange. Because in this example the U.S. vessel is sailing to China, the international data exchange will send the vessel's LRIT information to the data center serving China when the vessel announce its intention to enter a Chinese port. Because the U.S. vessel is also within 1,000 nautical miles of the Japanese coastline, the international data exchange will also send the vessel's LRIT information to the data center serving Japan.

The LRIT system is intended to provide secure communication. All data transmissions are to be made in secure formats and all data centers are to establish and maintain systems to ensure that LRIT data users are only provided with information for which they are entitled. To ensure data security, the international data exchange is required to be configured in a way that prevents it from viewing or accessing the LRIT data. Rather, it will only have access to the information stating where the LRIT data are to be sent.

The SOLAS amendment place the financial responsibility for the transmission of LRIT information on the country that receives the information. For example, information from a vessel that is sailing to the United States would be sent to the United States starting when the vessel was 2,000 nautical miles from the coastline. When the United States starts receiving that information, it would be liable for paying for the information from that point. The Coast Guard estimated in the final rule implementing the SOLAS amendment that the charges would be approximately $.25 per message.

Appendix II: Automatic Identification System (AIS)

This appendix provides additional information on the automated identification system (AIS). As a tool to improve navigation safety, AIS has been under development worldwide since the early 1990s. As a safety aid, AIS equipment allows a vessel's crew to "see" and track the movements of similarly equipped vessels and to receive pertinent navigational information from shore. The enactment of the Maritime Transportation and Security Act of 2002 and its implementing regulations gave AIS an added homeland security mission. To fulfill this mission, the Coast Guard is in the process of constructing a nationwide network of shore-based and other receiving stations to allow it to track the position and movements of AIS-equipped vessels.

An AIS unit onboard a vessel consists of a global navigation satellite system; computer hardware and software; three radio receivers; and one radio transmitter-receiver, or transceiver. The information to be transmitted by the AIS unit is obtained in different ways. Some information that does not change during a voyage is manually entered by the vessel's crew. Examples of this type of information include the vessel's name, identification number, dimensions, and cargo. Information that changes as the vessel proceeds on its voyage is entered by instruments onboard the vessel, including the navigation satellite receiver and the vessel's compass. This type of information includes position, course, speed, and rate of turn. The unit transmits the information on designated radio frequencies at rates ranging from every 2 seconds to every 6 minutes.

Once transmitted, the AIS signals are received by AIS stations within range. Typically, these stations are installed on other vessels or on shore, but the Coast Guard is working to expand its network of receiving stations to include offshore platforms, ocean buoys, and other locations. The land-based AIS stations require considerable infrastructure on shore—including antennas and base stations equipped with electric power, transceivers, computers, and displays—to monitor vessel activity and transmit information or instructions back to vessels. In locations where Coast Guard vessel traffic services are operational or where existing AIS capabilities existed, AIS signals received on local antennas are routed directly to the local vessel traffic center or Coast Guard sector command center. AIS signals received in other locations are first routed to the Coast Guard's Operations System Center in West Virginia and then distributed throughout the Coast Guard, and to other authorized agencies, as part of the Coast Guard's aggregated information system that includes vessel-tracking information from all unclassified sources known as the Common Operating Picture.

Appendix III: GAO Contact and Staff Acknowledgments

GAO Contact

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