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MEMORANDUM

JUN 29 2007

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CG-3

Reply to: CG-3PWN-1
Attn of: CDR J. Arenstam
2-1546

To: Distribution

Subj: LETTER OF PROMULGATION

1. The enclosed U.S. Coast Guard Maritime Short Range Aids to Navigation Strategic Plan describes a long term strategy to deliver a valuable navigation service to the country. Federal short range aids to navigation are essential to the nation's maritime transportation system. As a maritime nation, it is imperative that the United States retain capability and expertise to maintain this service throughout its complex system of waterways and in support of diverse uses of the maritime domain. 14 USC 2 mandates that "the Coast Guard shall develop, maintain, establish and operate, with due regard for the requirements of national defense, aids to maritime navigation for promotion of safety on and over the high seas and waters subject to the jurisdiction of the United States."
2. Through this Strategic Plan, the Coast Guard will maximize the availability and efficiency of the waterway system for all mariners, meet or exceed the navigation needs of mariners, ensure the appropriate mix of aids to navigation to mitigate transit risk, and maximize the Coast Guard's ability to quickly restore disrupted waterways, irrespective of the cause. The goals of the Strategic Plan are ambitious but they demonstrate the Coast Guard's commitment to providing a cost-effective and efficient aids to navigation system for all mariners.
3. The Office of Navigation Systems is assigned as Executive Agent of this plan. As Mission-Program Manager, the Office of Navigation Systems is responsible for developing plans and policy to enable the Short Range Aids to Navigation program to meet the mission requirements and strategic goals of the Coast Guard and this plan.
4. Collaboration among all offices that assist in the execution of the Aids to Navigation mission remains critical. All field commanders and Assistant Commandants should assist to the extent practicable in the execution of this strategy.

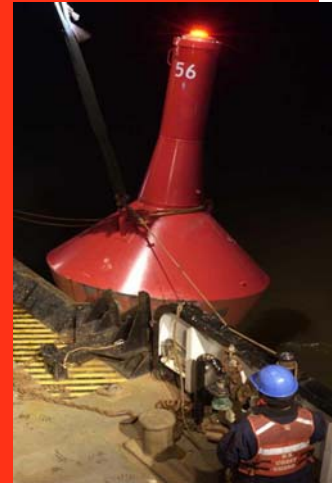
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Enclosures: (1) U.S. Coast Guard Maritime Short Range Aids to Navigation Strategic Plan

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U.S. Coast Guard Maritime Short - Range Aids to Navigation Strategic Plan



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Executive Summary

The mission of the Aids to Navigation (AtoN) program is to provide all users a reliable, cost-effective system of aids to navigation that will enable them to fix their vessel's position, determine a safe course to steer and avoid unseen dangers to the degree of accuracy appropriate to the level of risk. Mission accomplishment requires not only the continuous maintenance and improvement of the approximately 51,000 fixed and floating federal aids to navigation, but also periodic analysis and risk assessment of the efficiency of critical waterways through the WAMS (Waterway Analysis Management System) and PAWSA (Ports and Waterways Safety Assessment) processes, along with maintaining robust waterway restoration capabilities when disruptions do occur. The impacts of this mission reach well beyond the maritime community; virtually every American citizen benefits from the economic vitality made possible by an available and efficient marine transportation system.

Although there have been a variety of advances in the AtoN mission over the last decade, there has been no mechanism to formally capture, exploit, or standardize them throughout the Coast Guard. For at least the last five years, the Coast Guard has not had a coordinated, formal strategic plan for leveraging the latest AtoN technology in order to improve services while driving down costs. In many cases, individual district AtoN offices and units have independently experimented with new technologies with varying degrees of success. The focus of this strategy document is to provide the reader an overview of where the AtoN program "fits" in our nation's toolbox of maritime capabilities, capture and advertise the efficiencies of new AtoN-related technologies, foster coordinated integration and testing efforts, and promulgate policy for implementing on a service wide basis the various technologies that will continue to provide the best service available to the mariner while ensuring maximum return to the taxpayer.

The nation enjoys a significant return on investment from our Aids to Navigation fleet and infrastructure. The multi-tiered maintenance philosophy of the AtoN system ensures maximum system reliability while allowing multi-mission flexibility for the servicing units. Servicing units range from Aids to Navigation Teams (ANTs) to ocean going AtoN cutters. In the multi-tiered maintenance system, a channel may be marked with ocean and coastal buoys maintained by an AtoN cutter while smaller buoys, ranges, and fixed AtoN in the waterway are maintained by the ANT. The ANTs also play a critical role in maintaining the entire waterway when AtoN cutters are deployed out of their area of responsibility (AOR) or assigned to other missions.

Beyond maintaining fixed and floating aids, however, the AtoN program offers a variety of critical maritime competencies to the nation. Rapid response capability and ability to quickly adapt to a wide range of tasking are hallmarks of the AtoN fleet. During the winter months, our large buoy tenders and fleet of domestic icebreakers keep vital lifelines of fuel and raw materials flowing in the Great Lakes and throughout the Northeast. Pollution response operations are another critical mission for which the AtoN fleet is well equipped. ANTs are routinely called upon to provide platforms and personnel to meet ever-changing priorities based upon current threat levels.

Even more important to the vitality of America's marine transportation system is the inherent multi-mission capacity, capability, and authority that make the AtoN fleet an integral part of the many Coast Guard missions. The WLB/WLM (225/175 foot cutters) and WTGB/WYTL (140/65 foot cutters) fleets are routinely employed as part of the force structure to protect our major ports, and they surge full time into the Maritime Homeland Security role during periods of increased threat levels. The WLB/WLM fleet has been used for Law Enforcement (LE), Alien Migrant Interdiction Operations (AMIO), offshore Search and Rescue (SAR), Living Marine Resources (LMR) as well as Ports, Waterways, and Coastal Security (PWCS) missions. The inland fleet of WLR/WLI/WLIC river, buoy, and construction tenders are quite often the only significant Federal presence on our inland waterways, which are so critical to our nation's economy. These vessels are capable of serving in deterrence roles such as critical infrastructure protection. They are also well suited as logistic support vessels when operating with other Coast Guard units and operating with assets of other governmental agencies for lengthy High Interest Vessel /High Value Unit escorts along the inland waterway system. Their heavy lift capability also enables them to quickly transition to response/recovery operations whenever needed, as they so ably demonstrated in the wake of Hurricane Katrina. Additionally, the Office of Boat Forces has awarded a contract to replace the existing Trailerable Aids to Navigation Boat (TANB) fleet. The new TANB has increased capabilities and will better serve the ANTs during PWCS missions.

Background

Waterborne commerce has long been the lifeblood of our nation's economic system. Today, the safety and security of our nation's waterways is ever more critical to our economy and our national security. The unimpeded flow of the tremendous volume of cargo that passes through our ports and waterways is a vital aspect of the economic engine that drives our society. The AtoN system plays a key role in facilitating the safe transit of the tremendous volume of commerce that flows throughout our nation's waterways as well as in mitigating the inherent risks associated with transporting hazardous materials and dangerous cargoes through these environmentally sensitive areas. In addition, aids to navigation are vital for the rapid, safe, all-weather, anytime deployment and return of military vessels and cargo, as well as vessels that carry materials vital to keeping our nation safe in times of war and national emergency.

The AtoN program complements other waterways management activities to ensure safety of navigation at home and to support the nation's defense interests worldwide; it is key to the economic welfare and security of the United States and the U.S. Coast Guard's strategic goal of Maritime Stewardship.

Waterways management expertise and restoration capacity are essential to maritime preparedness and port resilience as is the ability to rapidly restore commerce and economic stability and ensure long-term recovery following massive damage, whether man-made or natural. As demonstrated in the wake of Hurricane Katrina, there is a strong connection between the AtoN mission and maritime infrastructure recovery and restoration as outlined in the Maritime Infrastructure Recovery Plan for the National Strategy for Maritime Security.

Advances and Trends in Aids to Navigation System, 1975-2005

The U.S. Coast Guard, per United States Code (14USC81), administers the United States Aids to Navigation (AtoN) System and is responsible for the development, establishment, operation, and maintenance of that system. The Coast Guard has consistently sought new equipment, techniques, and methods to "provide all waterway users with a reliable, cost-effective system of aids to navigation that will enable them to fix their vessel's position, determine a safe course to steer and avoid unseen dangers to the degree of accuracy appropriate to the level of risk." To the casual observer the buoys and beacons along our nation's coasts might look much the same as they did thirty years ago, except black buoys are now green and the black and white mid-channel buoys are now red and white. More in-depth consideration, however, will unveil that an extensive and ongoing technological transformation has been and continues to take place, not just on the buoys and beacons themselves but with servicing and maintenance practices as well. Some of the most significant and far-reaching advances include:

AtoN Positioning:

Until the late 1970s the instruments, methods, and techniques of positioning floating aids to navigation hadn't really changed much since the days of sail. The recognized most accurate way to position a buoy in the early 1970s, i.e., to verify that it was on its charted position, was to plot two horizontal sextant angles with a three-arm protractor on the largest scale chart available for the area. When the two angles intersected (defined as a two line of position (LOP) fix) in the

black dot of the buoy's chart symbol, then the buoy was considered to be on charted position. The fix was checked by adding at least one more LOP, i.e., angle, bearing, or range.¹

The emergence of technology, while in its infancy compared to advances of late, prompted the Coast Guard to commission a study in the mid 1970s to improve its capability to position aids to navigation by researching and applying available technology. The study's conclusions led the Coast Guard to implement new positioning methods that facilitated stricter, more accurate positioning standards. Some of these improvements included:

- Replacing the term “charted position” that previously defined an aid's position with an “assigned position” (AP). The AP definition eliminated errors introduced by chart inaccuracies by assigning a specific geographic location expressed in latitude and longitude with accuracy to the thousandths of a second.
- Developing “Accuracy Classifications” for buoys (“the area expressed as the radius of a circle in yards around the AP of an aid to navigation, within which the aid is considered to be on station”²) which varied according to the criticality and geographic attributes of the channel being marked, and allowed a system of prioritization for discrepancy response and channel restoration.
- Replacement of three arm protractors with a computer program that accounted for observer offset, excursion, and other potential inaccuracies. Instead of plotting the fix on a paper chart, the computer program took into account many of the possible inaccuracies and delivered a Most Probable Position (MPP) solution of the buoy's sinker expressed in latitude and longitude, the range and bearing from MPP to AP, and whether or not the buoy plotted on station.

While these efforts significantly improved the Coast Guard's AtoN positioning performance and thus aid reliability for the mariner and waterway safety, a lack of a sufficient number of surveyed objects in certain areas and poor visibility due to weather and darkness still hampered this time-consuming process. So in the continuing effort to improve the process of positioning aids to navigation, the Coast Guard built on the Defense Department's Global Positioning System (GPS) technology and by the early 1990s had developed and deployed the Differential Global Positioning System (DGPS). Today, the Coast Guard is able to position most aids to navigation in virtually any condition of visibility, day or night, with an unprecedented degree of accuracy. DGPS integrated with the Automated Aid Positioning System (AAPS) software has significantly improved AtoN positioning accuracy and mariner confidence that an aid is where it is supposed to be, while reducing the likelihood of personnel error, all at significant time savings. The results are a more reliable aid for the mariner and less Coast Guard asset time on scene, which translates to increased availability for involvement in other Coast Guard mission areas.

Solar Program:

Converting lighted AtoN power sources from primary batteries to solar power has been one of the most significant advances in the program in the last twenty-five years. This initiative has improved AtoN system reliability, increased servicing intervals, and reduced environmental impact of the program.

¹ Aids to Navigation Manual (CG-222) 1964 edition (Amend 2)

² Aids to Navigation Manual (COMDTINST M16500.1C), 1996

The Solar Program's initial goal in FY83 was to convert 10,000 lighted AtoN, or 66% of the total, from primary batteries to solar power. That goal was achieved by early 1988. To date, over 16,000 lighted AtoN (93% of all lighted AtoN) have been converted to solar power. All aids that feasibly can be solarized have been solarized. The remaining 7% will be re-evaluated for solarization as changes in technology occur or mariner requirements change.

Lighted AtoN powered via primary batteries required recharging every 12 to 36 months. Recharging AtoN was a laborious and dangerous undertaking which required bringing the buoy on board and removing and replacing a 215 to 508lb battery rack (depending on the number of batteries). For example, a lighted buoy before conversion to solar power required a buoy tender to replace the 508lb primary battery rack every two years. That same buoy after conversion, powered via a 35W solar panel and 2-60lb secondary batteries, does not need to be recharged for five years. And, with the advent of the exterior battery box, this same buoy can be recharged by a 3-person ANT from a small boat, enabling the cutter to focus on those AtoN maintenance issues, discrepancy response or other missions for which a cutter is required.

The Solar Program has enhanced the Coast Guard's commitment to protecting the environment by significantly reducing generation of hazardous waste, i.e. expended primary batteries. Solar or secondary batteries are recycled after their useful life span resulting in a hazardous material disposal cost avoidance of nearly \$600K annually.

Programmable Flashers:

The Coast Guard uses fifteen unique standard "rhythms" in lighted AtoN. In most cases these rhythms are controlled by a solid-state flasher. Since the early 1970s, these flashers (Type CG-181) were capable of emitting only one of the unique rhythms and could not be reprogrammed to emit a different rhythm. Therefore, AtoN servicing units were required to keep a number of flashers of every rhythm type in their onboard inventory. Programmable flashers, which can easily be reprogrammed to emit any standard Coast Guard rhythm, have allowed servicing units to reduce flasher inventory and have been in use since 2001.

Buoy Coatings Systems:

Replacing the Red Lead/Vinyl Paint system on buoys with an epoxy/polyurethane paint system has eliminated the requirement to perform paint touch-ups on buoys during annual servicing, further reducing the need for heavy-lift capability and allowing redeployment of heavy-lift cutters. This new paint system has also significantly lowered the Volatile Organic Compounds (VOC) released into the atmosphere during painting operations, thus improving air quality and reducing personnel health risks.

Aid Population History:

Between 1970 and 2006 there have been major changes in both the mix of servicing vessels and the number of AtoN. Tables 1 and 2 demonstrate how the Coast Guard is maintaining an increased number of aids using fewer, more efficient servicing vessels.

Table 1: Aid Population Changes.

Federal Aid Population Changes (1970 - 2006)				
Aid Type	Number of aids (1970)	Number of aids (1980)	Number of aids (1993)	Number of aids (2006)
Buoys				
Lighted	4200	4585	4431	4415
Unlighted	21900	23987	20402	20452
TOTAL BUOYS	26100	28572	24833	24867
Structures				
Lights	9432	10618	12084	12129
Daybeacons	8568	9074	13781	13753
TOTAL STRUCTURES	18000	19692	25865	25882
TOTAL AIDS	44100	48264	50698	50749

Lighted AtoN	13632	15203	16515	16544
Unlighted AtoN	30468	33061	34183	34205
TOTAL AIDS	44100	48264	50698	50749

Reference: Armacost, R. Dr. (1998, April). *Historical Summary of Aids to Navigation Analysis*. Department of Industrial Engineering and Management Systems, University of Central Florida. Prepared for U.S. Department of Transportation, USCG (G-O)

Total Aids includes 15065 unlighted Western River aids

Table 2: AtoN Servicing Vessel Population Changes.

AtoN Servicing Vessel Population Changes (1970 - 2006)			
	1970	1993	2006
WLB/WLM	53	37	30
WLI/WLIC	32	22	17
WLBB	0	0	1
WLR	25	18	18
WTGB w/barge	0	2	2
TOTALs	110	79	68
ANTs	0	66	65

Maritime Stewardship

The nation's prosperity relies on the balanced and sustainable use of inland, coastal, and ocean waters and resources. The foundation for this prosperity—an efficient, resilient MTS—must be maintained in order to facilitate maritime mobility and protect the nation's economy. At the same time, the marine environment must be protected against threats from pollution, environmental degradation, the spread of invasive species, and the illegal harvesting of marine resources.

The Coast Guard generates public value by performing roles and missions that ensure maritime safety, security, and stewardship. These roles and missions are enduring, long standing responsibilities, accrued to the Coast Guard over two centuries of service because they are inherently governmental, serve the collective good, and can be accomplished most effectively by a single Federal maritime force. The Nation's response to the terrorist attacks of September 11th and Hurricane Katrina, and the increasing pressures on our waterways and marine resources, are having a profound impact on the development of new management regimes for the U.S. maritime domain and borders. In this time of dynamic change, the Coast Guard's multi-mission nature, which has always been a strong value proposition to the nation, is taking on new dimensions and significance.

One of the elements of the Coast Guard's Maritime Stewardship role is to facilitate the economical movement of goods and people through the MTS and maximize access for recreational boating activity. In order to achieve this the Coast Guard provides navigation systems, information, and services that enable a safe, secure, efficient, effective, accessible, and environmentally responsible MTS for moving goods and people. The U.S. aids to navigation system is one of the tools that the Coast Guard has within its Waterways management activities to meet this obligation.

AtoN Mission Statement

Develop, establish, maintain, and operate with due regard for the requirements of national defense, short range aids to navigation systems for promotion of safety of all mariners on and over the high seas and waters subject to the jurisdiction of the United States. Provide short range aids to navigation and marine information services to contribute to a federal system of interventions designed to manage transit risk associated with the potential for collisions, allisions, and groundings.

AtoN Strategic Modernization and Efficiency Initiative

The Coast Guard is an integrator and partner in the national effort to revitalize the nation's Marine Transportation System (MTS). The Coast Guard will partner with a diverse array of national and international government, industry, and recreational stakeholders and be fully engaged in the urgent imperative to reshape the nation's fragile MTS, a fundamental component of which is the navigation system (to include Vessel Traffic Services, federal navigation authorities, the emerging e-navigation suite of services, and visual AtoN) that supports and enables the nation's MTS and whose immediate restoration after a maritime disaster is critical to the nation's economic and homeland security.

The improvements made in the past to the aids to navigation system have increased overall system reliability while reducing servicing frequency requirements. By leveraging technology, the Coast Guard is deploying more reliable components, more accurately, with fewer resources allowing servicing intervals to be extended up to three years on most AtoN and up to five years on unlighted structures.

CG-3PWN-1 will be responsible for measuring and monitoring the progress of the goals outlined in this initiative.

Further advances in technology have been made in the area of marine navigation equipment and AtoN. The Coast Guard continues to pursue new technologies to modernize the U.S. Aids to Navigation System in order to meet the needs of modern mariners and address our funding challenges. The aim of the AtoN Modernization and Efficiency initiative is to provide a safe, reliable, resilient and cost-effective AtoN system. The Initiative aims to maintain the same or improved level of service to mariners while:

- Reducing life cycle costs for the overall AtoN system
- Reducing the "capability" needed to maintain the U.S. Aids to Navigation System
- Increasing efficiency
- Increasing service intervals
- Improving performance and reliability of AtoN infrastructure

To accomplish this, the Modernization and Efficiency Initiative will:

1. Initiate an independent assessment of the performance of the Short Range Aids to Navigation (SRA) system in FY 2007.
2. Initiate a front-end analysis of SRA training systems to assess program training needs in response to changing crewing, technology, and assets, and in accordance with IALA (International Association of Marine Aids to Navigation and Lighthouse Authorities) recommendations.
3. Assist in the major acquisition and non-major acquisition processes for recapitalizing the boat and cutter capabilities necessary to deliver AtoN services to the nation.

4. Investigate Geographic Information System (GIS)-based waterways risk analysis modeling opportunities. This will allow for better visual display and determination of risk and risk mitigation efforts, and will greatly assist in determining if the existing aid constellation is the best and most efficient mix of lighted, unlighted, floating, fixed and electronic aids to navigation.
5. By 2015 reduce by 75% the number of sub cables. Eliminate CG maintenance of sub cables whenever possible, review current requirements at existing aid stations, and adjust installed gear but still maintain an acceptable level of transit risk in the waterway.
6. Reduce lifecycle costs of equipment at Lighthouses.
 - a. Reduce inventory of maintenance-intensive classical lenses, which require specific expertise to focus and refurbish. It is current CG policy that classical lenses are to remain as an optic in a federal aid as long as it is serviceable and the aid is still needed as an aid to navigation. If the lighthouse is to be transferred under National Historic Lighthouse preservation Act (NHLPA) the classical lens may be transferred with the lighthouse and used as a private aid to navigation or as a static display.
 - b. Install Light Emitting Diodes (LEDs) on major aids with 10-15 nautical mile nominal range, as the classical lenses are removed.
 - c. Review navigational necessity for landfall lights with nominal range greater than 15 nm.
 - d. Investigate District by District inconsistencies in need for and use of remote monitoring systems with the goal of reducing the number of monitoring systems on lighthouses.
7. Increase the use of self-contained LEDs on minor aids. LEDs need considerably less power than incandescent lamps and are increasingly being used in world-wide AtoN systems.
 - a. Replace incandescent lights with LED lanterns on 50% of red/green lighted buoys by the end of FY 2008, 75% by end of FY 2010.
 - b. Develop requirements for self-contained LED lanterns specific to lighting fixed structures in FY 2007.
 - c. In FY 2008, award contract for production of self-contained, red/green LED lanterns specific to lighting fixed structures.
 - d. By the end of FY 2009, install self-contained, red/green LED lanterns on 10% of fixed AtoN structures.
 - e. By the end of FY 2010, install self-contained, red/green LED lanterns on 20% of fixed AtoN structures.
 - f. By the end of FY 2011, install self-contained, red/green LED lanterns on 40% of fixed AtoN structures.
8. Investigate year-round buoys for ice prone areas to reduce servicing frequencies.

- 9.** Reduce lifecycle costs for buoy hulls:
 - a. In FY 2007, complete new lifecycle cost analysis comparison between steel and non-ferrous hulls.
 - b. Test/evaluate new non-ferrous hulls for offshore buoys.
 - c. Increase percentage of non-ferrous hulls for inshore aid stations.
- 10.** Install electronic chart system (ECS) for WLRs by the end of FY 2007 to increase unit efficiency.
- 11.** Implement data transfer of buoy positions to U.S. Army Corps of Engineers on Western Rivers by the end of FY 2007 to improve navigational information on inland electronic navigation charts.
- 12.** Investigate replacement for Tender Deployable Global Positioning System (TDGPS) by the end of FY 2007 to reduce cost of deploying aids to navigation in areas outside of DGPS coverage and increase efficiency on servicing platforms.
- 13.** Develop and implement new performance measures in FY 2007.
 - a. Implement new aid availability categories.
 - b. Implement changes to the Integrated Aids to Navigation Information System (I-ATONIS) to allow for capturing of temporary discrepancy response times.
- 14.** Complete evaluation of Automated Identification System (AIS) as replacement for the capability currently supplied by radar beacons (RACONs) by end of 2007.
- 15.** By FY2015, reduce by 50% the number of fog detectors from FY 2005 levels by switching to user-activated sound signals or discontinuing. Due to the proliferation of electronic charting systems the navigational need for sound signals is diminishing.
- 16.** By FY2015 reduce by 50% the number of sound signals on buoys from FY 2005 levels. Due to the proliferation of electronic charting systems the navigational need for sound signals is diminishing.
- 17.** Reduce total aid population by 5% from FY2005 levels by FY 2012. Given the advances in shipboard commercial navigation and upcoming carriage requirements changes there should be opportunities to reduce the category three aid population and still maintain a sufficient level of transit risk.
- 18.** As a result of the implementation of the items in this AtoN Modernization and Efficiency Initiative, increase average service interval nationwide, from the FY2006 level of 23.8 months, to:
 - a. 26.9 months by end of FY 2008; and
 - b. 30 months by end of FY 2010.

19. Replace critical wood range structures with standard CG Steel structures in storm-prone areas as the level of funding allows, with a goal of complete replacement of all structures by 2015.
20. Replace, where feasible, fixed AtoN that suffer from frequent allisions (average twice a year for three years) with more survivable AtoN, e.g. foam buoys.
21. Integrate AtoN information and measurement efforts into the Marine Information for Safety and Law Enforcement (MISLE) System/GIS. The integration of this information will provide the operational commander with an excellent visual display of the condition of the aids to navigation and waterway status within his or her AOR. In addition it will allow for improved measurement waterways management activities.
22. Incorporate the Buoy Body Transaction Report (BBTR) into a standard CG inventory control system in keeping with the efforts of logistics transformation.

Conclusion

Throughout its history, the Coast Guard has been a leader and innovator in improving its aids to navigation service by adapting and implementing technological advances to meet ever-increasing public demands for efficient and available waterways. Through this Strategic Plan, the Coast Guard will maximize the availability and efficiency of the waterway system for all mariners, meet or exceed the navigation needs of mariners, ensure the appropriate mix of aids to navigation to mitigate transit risk, and maximize the Coast Guard's ability to quickly restore disrupted waterways, irrespective of the cause. The goals of this Strategic Plan are ambitious, but they demonstrate the Coast Guard's continuing commitment to providing the most cost-effective, efficient aids to navigation system possible, and our intent to support the AtoN infrastructure critical to the maritime needs of the nation in the face of all threats, all hazards ... all the time.