

# Global Maritime Awareness

## A Strategic Imperative for International Maritime Security and Prosperity

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### The Challenge

Although all nations of the world, the developed and the developing, depend on maritime trade as the main engine that drives the global economy, the international community has, until very recently, largely ignored the very real vulnerabilities to its marine transportation system. Even now the efforts underway or being considered are not commensurate with the threat and its possible consequences. The industrialized world has seemingly turned its back on the extraordinary impact that a terrorist attack in one or more of our ports would have on worldwide commerce. Nowhere is this truer than here in the United States. Seven years after the horrific attacks of Sept 11, 2001, the major seafaring nations of the world do not even have a common comprehensive international maritime operating picture. Until very recently Northern Command (NORTHCOM) and the Navy were both focused on classified systems that have much valuable information and provide a basis for a realistic picture, but that information cannot be shared with most foreign nations with whom the United States needs to collaborate and exchange information. To do that, an unclassified system is required.

The solution can only be one that can be shared at appropriate levels between all nations, and which will provide an incentive for each country to participate in this data base. This would include coastwise trade, international shipping, fishing vessels, recreational boaters, environmental impacts, safety and security information that all nations must be knowledgeable about. In order to be viable for all of those entities to enter data and to receive information that is important to their security, the system must be unclassified, and primarily law enforcement based. This is not just a problem for the United States, or even just the maritime nations of the world. The world maritime trading system sustains the world's economy—not just the economy of the United States and the other developed maritime nations. The world-wide economy lives by

maritime transportation. The security of our nation and other developed nations depends on information and the eager participation of all nations involved in international trade. In order to get the information the maritime security of the United States requires, we must be willing to share that information with all of our trading partners. Therefore, the solution cannot be a classified system.

## The Diversity of Requirements

For law enforcement agencies worldwide, it is a requirement that they share potentially important terrorist information in order to intercept and prevent an attack before it can disable parts of the system. As an example, look at just the following handful of ports, and consider the wide variety of information they may require in order to participate and gain valuable information for their own use. Singapore, London, Sidney, Abu Dhabi, Rio de Janerio, Panama, Boston, Shanghai, Copenhagen. Each is very different, with both similar as well as widely differing information requirements. The list could go on for thousands of ports worldwide that are involved in the international trade. To make the information available to each nation, and to openly share critical law enforcement data, requires a system that is flexible to the varied requirements of each port, and with a common system architecture that allows even developing nations to become full participants.

International cooperation is key to solving this challenge. The Government Accountability Office (GAO) report on Maritime Security published in June, 2008, states “the goal of the Maritime Commerce Security Plan is to improve the security of the maritime supply chain, and one of the goals of the National Plan to Achieve Maritime Domain Awareness is to enhance transparency in the maritime domain.” Classified systems provide enormously valuable intelligence information on maritime security. Their effectiveness is multiplied by the cross referencing of international shipping information. On the surface that is what makes international information sharing most effective and valuable. What really will happen on the pathway to cooperative maritime information sharing is more like this: the international partnerships will build trust, which builds information sharing which builds Maritime Domain Awareness which

builds effectiveness which builds prevention which builds success----internationally, and strategic defeat of any terrorist groups.

## A Start

The United States has begun to lay the groundwork of such a system in both the national policy and technology realms, but it is taking a lot longer than many of us thought it would. The first MDA Summit was held on 7 May 2004. Participants included nearly all of the 25 federal agencies and organizations involved in maritime matters. After much discussion it was agreed the Coast Guard would assume the lead role in developing the system. The Chief of Naval operations, ADM Vern Clark, pledged the Navy to be “the #1 supporter.” At this meeting it was also agreed that there was a need for a national policy on maritime security and a Senior Steering Group was appointed to draft one. Eight supporting committees were also created. The result was National Security Presidential Directive-41/Homeland Security Presidential Directive-13 (NSPD-41/HSPD-13) which establishes U.S. policy for enhancing our national security and protecting our interests in the maritime domain. Specifically, NSPD-41/HSPD-13 directs that “Maritime Domain Awareness” (MDA) efforts be undertaken: “to develop an enhanced capability to identify threats to the Maritime Domain as early and as distant from our shores as possible by integrating intelligence, surveillance, observation, and navigation systems into a common operating picture accessible throughout the United States Government.”

One of the main ways to accomplish this tasking may well be to build, in collaboration with our international partners, a common operational picture developed from unclassified terrestrial maritime systems combined with commercial and civilian space systems on a global scale. The envisioned global information sharing dictates the avoidance of the use of classified systems. All understand the utility of supplementing this system with classified information by each nation or organization according to their own needs and capabilities. Still, it must be reiterated, the underlying core system must be unclassified in order to be of the most use to the most people as well as making the open source and business specific information available to the governments of the world.

One major example of a system that could provide significant worldwide maritime domain awareness is space systems. Civilian and commercial earth surveillance satellites are a reality and more, and more capable ones, are just around the corner. One study reports 31 optical systems in orbit as of late 2006, with an additional 27 planned and 4 radar satellites in orbit, with another 9 planned.<sup>1</sup> Indeed, it was reported at the Earth Observation Business Network 2008, held in May 2008 and attended by the 19 countries and 15 companies that own or operate earth observation satellites that, with the launch of Canada's RadarSat 2 in December 2007 there are now 7 SAR satellites in orbit.<sup>2</sup> The numbers are only expected to grow in the coming years. Many of these systems have significant ocean surveillance capabilities which, if bundled together and used intelligently, could provide the maritime nations of the world with a much better picture of who is on the "global commons" and what their intentions are. This system of civil space systems would not be cheap but this author believes the potential benefits would far outweigh the costs. The cost to world's economy from polluters, resource thieves such as fish poachers, smugglers of all types including drug runners and illegal human cargo movers, is huge. It is many billions of dollars in African waters alone, according to Admiral Harry Ulrich in remarks made in May, 2007 at a meeting of the Africa Institute.<sup>3</sup> Terrorism and security are also concerns, and such a system as is envisioned could also be used to detect vessels acting in an anomalous manner which might be a potential tip-off to a security threat such as terrorists. The building and maintaining such a system could also be an excellent means to foster cooperation among nations world-wide for trade regulation as well as for environmental monitoring, humanitarian assistance, and disaster relief.

Many senior decision makers believe such a system is impossible to build from a cost viewpoint, if nothing else. However, they, and the vast majority of people, are unaware of the many pieces already in place. One of the core attributes of the maritime domain is the fact that for centuries the movements of ships of all types, be they warships, traders, fishers or other resource gatherers, were concealed from prying eyes ashore. This concealment led to

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<sup>1</sup><http://www.asprs.org/news/satellites/> ASPRS Guide to Land Imaging Satellites

<sup>2</sup> Author attended as speaker and participant.

<sup>3</sup> Speech by ADM Harry Ulrich, African Institute, Washing, DC

commercial advantage in trade and tactical, operational and even strategic advantage for navies. Fishermen gained both commercial and tactical/operational advantages.

Across the centuries, mariners of all types have come to take the concealment the distance from shore and its prying eyes the broad ocean area provides for granted. Breaking that paradigm, which is an international mindset, may not be easy, but the technology is at hand in the civil community to detect, identify and track ships of all sizes on all corners of the global commons. Owners and operators of vessels of any significant size will need to adjust to the new paradigm of maritime "Transparency" as articulated by Dana Goward, the Director of Maritime Domain Awareness for the Coast Guard and Executive Director of the federal government's Maritime Domain Awareness Implementation Team from 2006-2007. That interagency team was created by White House direction to develop the way ahead to implement the National Plan to Achieve Maritime Domain Awareness, a presidentially tasked major supporting element of the National Strategy for Maritime Security. The team studied how to make both the United States as well as the world's maritime interests secure from all manner of threats, and the concept of "Transparency" is a core concept. "Transparency generates self correcting behavior" is a maxim of his, and the envisioned civilian satellite based ocean surveillance system could go a long way toward generating that transparency.

To achieve that transparency while preserving commercial and international interests, a core tenant of this concept is the fact that it is needs to be classified for "For Governmental Use Only (FGUO)", and is thus widely sharable across the maritime partner nations of the world. There is also a parallel to build a wide-ranging classified system that is being called "Coalition Operationally Responsive Space (C-ORS). It is a very useful concept with many excellent attributes, but it is a classified system and does not satisfy the need in the maritime domain for truly sharable data from unclassified, all source systems.

Many of us that have been associated even tangentially with the space industry have known for some years that civilian radar and imaging satellites have been successfully deployed in space and that others were being built while still others are being planned or contemplated. However, the general public, and even many senior decision-makers, are unaware of the

advanced state of development in these systems. Generally, the major detractor of using these types of surveillance systems for persistent oceanic surveillance was the widespread belief that it would take a significant, dedicated constellation of satellites, with each satellite costing many hundreds of millions, if not billions, to provide effective persistent maritime domain awareness on a national scale, much less on the envisioned global maritime situation awareness which is being proposed here.

With the successful completion of a wide ranging test from the Mediterranean to the east coast of the United States in the Fall of 2006 which used synthetic aperture radar satellites, coupled with electro-optic and infrared (EO/IR) imaging satellites, and the successful launch of satellites which contained an automatic identification system (AIS) receiver, the real possibility of using civilian satellites for persistent oceanic surveillance has come much more sharply into focus. This test was conducted by a consortium led by the University of Miami's Center for Southeastern Tropical Advanced Remote Sensing (CSTARS), and included the European Union's European Space Agency, the US Air Force and the Defense Intelligence Agency. It clearly showed that civil space systems could detect and maintain a tactically useful track on a range of surface vessels across a major ocean.

There are many different types of satellites, but there are only a few that are directly pertinent to the task of global maritime situation awareness. Certainly communications, navigation and weather satellites contribute to the safe operation of ships at sea, but here we are discussing ocean surveillance systems, including synthetic aperture radar, electric-optic/infrared (EO/IR) imaging, and AIS carrying satellites. A special subset of communications satellites, those that carry transponders that talk to identification and location beacons will also be discussed briefly. Each of these systems has a unique role to play in ocean surveillance. To more clearly define those roles, a rough concept of operation for a space based civilian monitoring of the world's ocean will conclude this paper. A brief description of each of the basic types of satellites pertinent to maritime surveillance is provided in the end notes in order to understand what basic capabilities each of these different types of satellites bring to the problem. Suffice it to say here that there is no "silver bullet". We need all three types of satellites, at a minimum. It may well be that other earth observation satellites currently used in oceanography,

weather, or other earth science endeavors will provide critical information to the MDA system we are proposing.

The CNO has proposed the building of a 1,000 ship Navy (TSN) via the generation of a Global Maritime Partnership (GMP). One of the ideas linked to this concept is the building of the maritime equivalent of the International Civil Aviation Organization (ICAO) which track all airlines world-wide, as was mentioned above. Indeed, since 9/11 the concept of tracking ships world-wide has gained some acceptance with the enactment of the 96 hour Advanced Notice of Arrival (ANOVA) before a commercial ship can enter any US port, and the IMO's enacting, at the instigation of the US, the Long Range Identification and Tracking (LRIT) requirements. LRIT has created 3 classes of maritime nations and countries can be in all three categories (Flag state, a country who owns the vessel; Port state, the country to which the ship is bound; and Coastal state, a country whose maritime domain, which for the purposes of this requirement, extends out to 1,000 NM, will be traversed by the reporting vessel.) The problem with each of these requirements is that there is no cost effective means to determine if the reporting requirements are being met, or if there are ships which are ignoring these reporting requirements. Ships which must report are commonly referred to as the SOLAS class after another IMO safety regulation. The Safety of Life at Sea (SOLAS) requirement specifies that ships which fall within its definitions must carry both the InMarSat-C satellite communications system and the Automatic Identification System (AIS), a restricted waterways mutual identification and collision avoidance system.

AIS has also proven very useful in several ways and is now used world-wide as a primary means of identification when within line of sight of most of the world's significantly inhabited coasts. There are two main drawbacks to AIS. First, the ship has to be equipped with the system, and most of the world's smaller ships are not, and it is only a line of sight (LOS) system, meaning the receiver must be within LOS of the transmitter. That range is determined by the height of the two systems' antennas, and on most ships and harbor installations that means something less than 25 miles. One way to overcome this limitation is to put the receiver in an elevated position such as an aerostat moored near the harbor, in an aircraft, a UAV, or on a satellite. The most advanced system currently available for that task is the Coast Guard's

Maritime Safety and Security Information System (MSSIS). It allows for the display and parsing of AIS data in a number of ways. It currently handles only AIS data, but efforts are underway to include radar data in the system as well. In that MSSIS is an unclassified system it is being shared with a number of foreign countries, especially around the Mediterranean where the Commander, Naval Forces Europe, a major impetus to the final design of the system, has been proactively promoting it with a wide range of foreign partners.

Another system with international focus is the joint DOD/DOS Regional Maritime Awareness Capability (RMAC). DOD is the lead agency, with OSD/Advanced Systems & Concepts managing the effort as a Joint Capabilities Technology Demonstration (JCTD). It is focused on using *commercially available systems* to develop a harbor and coastal approaches focused observations and reporting system. The only really new part of the system is its data correlation/sharing/reporting system.

The main drawback to each of the above systems, as was discussed earlier, is that they are basically limited to line of sight from the shore. The proposed civil space based system would overcome that limitation.

Ocean surveillance systems developed during the Cold War remain classified and our nation is reluctant, rightfully so, to discuss how good they really are. However, their main drawback may well be the fact that the information they generate cannot be shared with the vast majority of our partners. This is true at least in part due to the necessity to not let anyone without a strict need to know exactly how good these systems are and what vulnerabilities they might have. Thus Tom Clancy is allowed to speculate to his heart's content. However, astute observers with some basic knowledge of physics, such as our potential enemies, will quickly come to realize Tom has either been sold a bill of goods in many cases, or has a great sense of humor, or both.

The integrated involvement of the international maritime nations is essential if the United States can be successful in leading the maritime security efforts essential to the world's economic future. The June 2008 GAO report on Maritime Security states "More than 6 years



after the September 11, 2001, attacks, the risk of a terrorist attack in the maritime domain remains a major concern to the United States.” The question then is how to share the international maritime security information from all of the nations involved. How do you get the international community focused on collectively working in unison to defeat the terrorists, the fanatics, of whatever persuasion. This is guerilla warfare in the modern sense, and the asymmetric focus of these attacks will not be defeated by a strategy focused on highly classified intelligence and high technology warfare. It must be defeated in the same way that other guerilla wars have been won, through the hearts and minds of the people—in this case, the international community and specifically the Muslim community.

The central issue then is how to get international cooperation. Each individual nation must be able to provide unclassified information on the maritime shipping and movement of international cargo, as well as passenger and crew information.

Let’s not fool ourselves, the size and scope of the challenge is enormous. The world moves over 270 million TEUs of containers every year, and that number will most likely continue to grow. More than 12 million TEUs are shipped directly to the United States from nearly 700 foreign ports. While 85% of the containers come from only 58 ports, this accounts for only the containerized cargo. The original shipping point of any container is key information, as well as the security and integrity of the shipment within the container en route to its destination.

The container shipments are only one sector of the maritime equation. Bulk cargo shipments are also a threat. How easy would it be to hide a WMD in a ship filled with soy beans, or zinc? Add to that equation the cruise ship industry, the fishing vessels working offshore of every maritime nation in the world, as well as naval, research, training, or private international vessels, and the complexity of the challenge becomes readily apparent.

The solution must enable the focusing of our efforts to strengthen the capabilities of partner countries to provide the shipping information needed by all nations to protect themselves, their people, and their economic infrastructure. Once this information is accumulated and put into one repository, the sheer volume and type of information will make the data base sensitive.

So, securing this data base, and ensuring it is used by only those governments cooperatively working together, will require a new classification. This new classification should be FGUO (For Government Use Only). This new international classification system would allow participating governments to share unclassified information needed by the international community, and keep the resultant database secure from the enemy gaining access to open source data. Each nation would be free to input data and retrieve data affecting their safety and security. Only those countries participating in providing necessary information would be allowed to retrieve information from the system. In that way the benefit of their efforts to input data would be reciprocated by the availability of critical shipping data from other countries.

#### Rough Concept of Operations:

The set of satellites described previously would be used to openly surveil the world's ocean. Most of these systems are already employed in other tasks than maritime surveillance, but procedures would be established whereby they would be tasked as needed to provide the degree of coverage deemed necessary. With task load sharing between the multiple systems it is believed possible to maintain any degree of surveillance deemed necessary, from sporadic to persistent and pervasive. The exact time of the pass of each specific system might only be known to the world's maritime governments, and not readily available to the general maritime populace to increase the perception that the system was "all seeing." The satellite system would be used to establish exactly what are the normal patterns of behavior for shipping and boating, world-wide. The operational cycle of the system would begin with the tasking of one of a constellation of synthetic aperture radar satellites, possibly not all from the same manufacturer or even country, and probably not with exactly the same sensor or even operating in the same band, to collect the data from wide area search mode and then most likely switch to a spotlight mode to refine the detected targets attributes. It might even be that it will be a second satellite that does the more fine grain surveillance before a third or fourth satellite, equipped with optical sensors operating in the visible or IR or hyper-spectral bands conducts a fourth or fifth or greater collect on the same target. Ship information compiled from unclassified sources and pertinent to the area under observation would also be scoured for supporting information such as the LRIT and AIS reporting systems as well as other corroborating information gathered from terrestrial

unclassified sources. If deemed appropriate, and weather permitting, a high resolution EO/IR imaging satellite would be tasked to image the correct spot in the ocean and the image processed to further determine a ship's location and course and speed. If an image is not gained, then analysis will need to be conducted to understand why it was not. Has the ship in question altered course? Sped up? Slowed down? Is it behaving in a rational manner? A suspicious manner? Other sources and methods would need to be employed to gain further information, but the basic data would be provided by the envisioned, unclassified system.

The keys to this concept of operations are 1) commercial satellite information, 2) shipping, cargo, passenger and crew information, and 3) the cross referencing and analysis of this information by individual governments. The entire data sets provided by international companies are key to making the information valuable to all of the participating nations. The individual goal of each analysis may be to determine if the vessel is engaged in illegal fishing, or engaged in dumping oil at sea, or in human smuggling. This information could also be cross referenced with other national data to better determine the vessels identity or activities. Based on that more complete data field of information, the decision could be logically made to send law enforcement or naval vessels or aircraft to intercept and board the ship.

Projects are underway to also develop anomaly detection algorithms which might also provide clues as to whether a vessel was behaving in an abnormal manner and might be engaged in any of these activities or even, terrorist related activities. This CBS-BOSS is not a silver bullet, but it would be a huge help in establishing the envisioned "Transparency" for all maritime nations.

Once this information is brought into the system, the combination with space based systems could provide a cross reference that would be most valuable. Much of the specific shipping information provided to the FGUO system would be directly observed or reported from company or agency data fields. This information would be cross referenced with technical, classified information, with the results being many times timely and predictive. The combination of all source intelligence would benefit the United States first. It would multiply the effectiveness of our classified systems, and bring relevance to specific data. While the net affect

of the all source fusion would be significant, the involvement and active participation and involvement of the international maritime community would be the single most important strategic difference, and the most important benefit. The resultant international condemnation of the terrorist's total disregard for human life is what will eventually defeat the terrorist.

The dawn of unclassified open ocean surveillance has already occurred, but few have noticed. These systems do not replace the national classified systems, but have other huge advantages in that they can be used and their data shared with the many nations of the world. The surveillance, data discovery and fusion, high capacity data display and dissemination capabilities must be organized and used. Certainly others will move to make this capability available to a wide range of other actors, including some with good intentions, most with profit in mind, but still others with more with evil thoughts and intentions. We need to even the playing field, if nothing else.

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