



Building Maritime Security Situational Awareness

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Abstract

Maritime domain security relies on the ability to build a comprehensive awareness of maritime activity. Although it is still in the developmental stages *situational awareness* is the prerequisite of *maritime domain security*. Today technological developments such as space-based systems, over-the-horizon radar, and near-shore and harbour acoustics can be incorporated into a layered approach to increase security. To identify and address weaknesses in the system, industry and academia have been discussing ways in which technology, based on advanced modelling and simulation tools can be used to identify threats and determine potential impacts. Numerous governmental, military and business organizations already possess valuable inputs into shared situational awareness. However, no one source captures all of the maritime information needed or currently available. The information exchange between government agencies and with private industry, in particular, sharing common databases, is the real power behind *maritime domain awareness* centres.

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ANALYSIS

A Global Common

Germany and Korea have much in common. Both nations can look back on spectacular economic achievements in the post-war years. Both nations have bitter experience of what it means to be a divided country. And both nations are in their security and prosperity highly dependent on the maritime domain.¹ The oceans connect nations globally through an interdependent network of economic, financial, social and political relationships. The enduring prosperity of the world's industrialised democracies as well as the steady rise of new economic powers, such as Brazil, China, India and Korea, owes much to the fact that the world's maritime spaces have been, by and large, a secure and safe domain. Yet, the emerging maritime environment in this second decade of the 21st century appears to become different from the past – a shared, global common good, vast but fragile and in need of worldwide management and protection.

The world's maritime domain has become an increasingly accessible environment, including the transport and deployment of weapons of mass destruction and associated materials, a growing range and rate of pirate attacks, which raise concerns about the safety of vessel crews and private citizens.² Globalisation has reduced barriers particularly for transnational criminal and terrorist activities. Issues of jurisdiction of merchant vessels using Flags of Convenience but crewed by nationals of many different states further complicate the security tapestry. To safeguard the international community from risks and vulnerabilities and to enable economic growth and commerce, it is of key importance to protect freedom of access throughout the *global commons*, working in close cooperation with capable, interoperable allies and partners around the world.³

Of course, the utility of the *maritime domain* depends on much more than just ships and harbours. The transmission of information such as orders, inventories, and the tracking of assets utilizes a vast network of both intercontinental undersea cables and space-based satellite links, and is a critical enabler of *just in time* or *on demand* business models. The *maritime domain* is one of the global commons four domains – maritime, air, outer space, and cyber space. Maritime and air are the international oceans and skies that do not fall under the jurisdiction of any nation. Outer space begins at the point above the earth where objects remain in orbit, while cyberspace is a digital world generated by computer networks in which people and computers interoperate. Mankind has used the maritime domain for thousands of years, air for a century, and space for about six decades. Cyberspace has been widely available for less than thirty years; yet today more than a quarter of the world population use it every day. While command of the sea by naval superiority in the past used to provide global reach, freedom of movement and secure access, the same command is in modern terms not realistic without an unhindered access to the air, outer space and cyber space domains.

Consequently, in the 21st century access to the *global commons* has become of particular importance to the security and prosperity of nations. It binds together domains that are indispensable for the free flow of goods,

¹ U.S. National Plan to achieve Maritime domain Awareness for the National strategy for Maritime Security, October 2005 http://www.dhs.gov/xlibrary/assets/HSPD_MDAPlan.pdf pg. 1 (access: 24 Feb 2012)

² See: United States Government Accountability Office, Intelligence, Surveillance and Reconnaissance – DoD needs a Strategic, Risk-based approach to enhance its Maritime Domain Awareness, GAO-11-621, Washington June 2011

³ See: ACT, Assured Access to the Global Commons by Major General Mark Barrett Dick Bedford Elizabeth Skinner Eva Verges Norfolk, Virginia USA, 3 April 2011 http://mne.oslo.mil.no:8080/Multinatio/MNE7/NATOACTAcc/file/ACT%20Access%20to%20the%20Global%20Commons_Final%20report.pdf



people, resources and information.⁴ The sea provides over 90 percent of global trade. The global economic impact of air transport is estimated to 7.5 percent of global GDP. The economic worth of communications, imagery, and positioning data gained from satellites in space is rapidly increasing; and each day, financial traders in New York City transfer approximately 25 percent of the annual U.S. GDP via the Internet.

Security Trends

Crises involving the *maritime domain* have the potential to involve major disruptions to the movement of cargo within the global supply chain. Freedom of navigation, sea-based trade routes, critical infrastructure, energy flows, protection of marine resources and environmental safety are of significant importance with regard to security and prosperity of nations worldwide. Global trade relies upon secure and low-cost international maritime transportation and distribution networks. It now stands at over 90 percent of world trade and includes 60 percent of all petroleum exports. But these networks are vulnerable to disruption, to the extent that even short interruptions would seriously impact international trade and economies. Additionally, there are fisheries and other highly valuable resources that lie in, on and beneath the ocean floor. Meanwhile, climatic changes pose new opportunities and challenges, which may allow new and economically attractive sea routes, as well as improved access to resources.

Risks and vulnerabilities to the *maritime domain* have to be understood against a broad background. One pillar of the emerging new world order is an extensive range of international law, norms and practices developed over decades and centuries. Another pillar of the world order is the naval dominance of Great Powers supportive of free trade, freedom of the seas and related principles. As the international community is based on states, these have not only rights, but also obligations. Unfortunately many states are too weak to control their own territory, including the maritime parts of it. Other states have grown stronger and consequently have come in a position to make claims on maritime territory.

From European perspective we observe that:

- As Asian economies are growing rapidly, so does the need for raw materials and especially energy resources.
- There are a large number of territorial disputes in Asia, both on land and in the *maritime domain*. Several disputed areas contain substantial oil and gas fields.
- Most Asian states are investing significantly in arms and military capabilities. This creates multiple security dilemmas and distrust between states.
- Military shows of force in order to support territorial claims have occurred frequently in the recent past and added to a climate where states actively seek to balance threats.
- Naval capabilities have been increasing rapidly in Asia. Thus wars between Asian powers would likely have a strong maritime dimension. The increased reach of these navies also means that hostilities would affect a larger geographical maritime area than in the past.

⁴ See: Heiko Borchert, The Future of Maritime surveillance in an Era of Contested Maritime Domains, October 2011 http://www.coecsw.org/Proceedings/newmaterial/110625_Dr%20Heiko%20Borchert_The%20Future%20of%20Maritime%20Surveillance.pdf (access 24 Feb 2012)



The security developments at sea present the international community with three principal challenges:

- Lawlessness – expanded lawlessness with its impact on seaborne trade and travel as well as on the reliability of energy supply could lead – via an erosion of trade and trust among nations – to a declining prosperity for all. Ungoverned maritime spaces must not become a vast refuge for non-state criminal groups of all sorts and for nation-states that may sponsor illicit activities, such as terrorism or WMD proliferation.
- Competition – naval shipbuilding programmes of major powers in Asia ostensibly aim at acquiring an indigenous capacity to patrol and protect the sea lines of communications. On the one hand, this underpins their newly acquired major trading partner status, making them welcome stakeholders in the pursuit of enhanced maritime security. International counter-piracy operations in the western Indian Ocean, as well as multinational maritime exercises involving an expanding number of Pacific basin nations, are compelling illustrations of this positive trend. On the other hand, these programmes also carry with them an embedded sea-denial capability. Strategic naval competitions clearly bear the risk that maritime means might become employed for the purpose of political intimidation, military coercion or even big power conflict.
- Climate change – a key impact of Climate change is the opening up of the Arctic seaways. This has significant implications for shipping and access to resources throughout the High North. It also raises the question of how to address regional security issues. Especially, when the region's strategic geography means that the sea provides the most likely or even the only means of access.

Raw materials, especially oil and gas, are in high demand. Increasingly markets and states have realized that these resources are finite. Access to important raw materials has become increasingly a strategic consideration for most developed and developing states. Technology for offshore exploitation of oil and gas resources have improved dramatically during the last decade, and enabled production in extended areas. This, alongside higher prices, has activated a couple of latent territorial disputes.

Fortunately, up to now key sea-lanes in East Asia have been well protected by the U.S. Asia-Pacific navy force. The United States have demonstrated a particular and significant role in promoting peace and stability here in East Asia as they have greatly contributed to prevent the proliferation of weapons of mass destruction, conducted anti-terrorism activities on a large scale, and provided disaster relief.⁵ Consequently, it comes as no surprise that the most recent strategic defence guidance from the Obama administration has refocused the U.S. defence posture on the increasingly competitive security environment emerging in the Pacific. They will seek to protect freedom of access throughout the global commons, working in close cooperation with capable, interoperable global and regional allies and partners.

Western naval capabilities have been instrumental in securing the global Sea Lines of Communication for centuries. However, Western naval capabilities have been dramatically reduced in quantitative terms during the last two decades. This is especially true for classes of relatively inexpensive ships needed to maintain a continuous naval presence around the world. Regional security regimes have already taken on responsibilities to secure certain areas. The regional cooperation to secure the Malacca Strait is a fitting example. Moreover, a

⁵ See: Kim Kwan Jin, Minister of National Defense, Republic of Korea, Asia's New Distribution of Power and its Implications Singapore, 4 June 2011 <http://www.iiss.org/conferences/the-shangri-la-dialogue/shangri-la-dialogue-2011/speeches/third-plenary-session/kim-kwan-jin/> (access 24 Feb 2012)



large number of states have contributed to the fight against piracy in the Gulf of Aden and the Indian Ocean. From a world order perspective such regimes and contributions are force multipliers.

However, as challenging maritime threats coming from asymmetric sources are, the remaining symmetric challenges require focus as well. Two nations that stand out in their development of anti-access capabilities are China and Iran. Iran's ability to close the Straits of Hormuz remains a key strategic issue. Iran sees the necessity of negating key U.S. advantages in the global commons as critical to success in any military engagement with the United States. Consequently, Iran is working to modernize and augment its arsenal of military capabilities and refine its methods to debilitate U.S. forces in the Persian Gulf. Iran has a significant mine-laying capability, which presents a threat to larger commercial and military vessels navigating the narrow passageways of the Gulf and the Strait of Hormuz. Over 90 percent of Persian Gulf oil passes through the Strait of Hormuz, making it a strategic chokepoint whose disruption would have severe consequences for the global economy. Even absent a crisis, this increasing militarization of a waterway that is so critical to global resource distribution is of concern to maritime security.

On the basis of its economic strength, China is rapidly expanding its influence over a wide range of areas in the international community. The rise of China has quickly and deeply impacted its neighbouring countries in the region due to the political, economical and cultural connection between these nations. But China's natural resource dependency is causing it to invest also in areas well outside its traditional spheres of interest and operation, such as the Indian and Arctic Ocean regions. It is building a blue-water navy to support this requirement. The Chinese have and continue to develop land-based anti-ship ballistic missiles, anti-ship cruise missiles, air-launched cruise missiles, diesel-electric submarines, and maritime intelligence, surveillance, and reconnaissance capabilities.

With regard to the economic prosperity and security order of East Asia, China has already taken its place as an important actor. Specifically, China's assertion of exclusionary rights in its exclusive economic zone⁶ (EEZ) and its territorial claims in the South China Sea heighten suspicion of Chinese intentions in the region. If other states follow suit to prevent safe, unrestricted passage of sea vessels through their EEZ, the openness of the commons is directly challenged and could have devastating economic results. On a positive note, China has shown some signs of beneficent intentions by increasing its role in international counter-piracy missions. Already in 2008, the PLA Navy sent warships to join U.S. naval operators patrolling the Somali Coast. More recently, Beijing has expressed interest in leading some of the planning of such missions.

Also the Russian Navy deserves attention. Russia has deployed recently significant naval power to three different oceans, despite enduring financial questions about Moscow's ability to build and operate its navy. Russia remains the world's second largest nuclear power, is potentially an energy superpower and in 2008 launched an air, land and sea attack on a sovereign nation.

Last but not least, *maritime domain security* in the Northeast Asian region is directly intertwined with the settlement of lasting peace on the Korean peninsula. As North Korea continues to develop nuclear weapons and provoke militarily, these actions severely threaten the peace in East Asia and beyond. North Korea's development of nuclear capabilities actually spurs on an arms race between its neighbouring countries. It exerts a sig-

⁶ These are sea zones over which a state has special rights over the exploration and use of resources, including production of energy from water and wind.



nificantly negative influence on the security interests of the U.S. and China, as well as on the establishment of peace across the entire Northeast Asian region.

While the world order of the past decades basically has been built by Western powers, presently the relative distribution of economic power is shifting rapidly to the east. The same trend applies to military power. The finance crisis has increased the speed of both trends and is likely to continue to do so. Against this background there is a real risk that Great Power rivalry and competition will increase. Multilateral institutions and norms may be eroded and weakened. Physical control of resources is likely to become more important. If trust in the world market and secure lines of communication decreases, conflict over territory and resources becomes more likely.

The lack of local maritime capabilities in some parts of the world is dysfunctional to the emerging world order. Especially in the light of decreasing Western naval capabilities, it becomes important to convince and enable states or regional organizations to take on their international obligations in their own territorial waters and exclusive economic zones. Another challenge is to convince emerging powers and other stakeholders in the world order to actively contribute to the fight against piracy and terrorism in the *maritime domain*. While many states have contributed with ships and other resources to the anti-piracy operations in the Gulf of Aden and Indian Ocean during the last several years, the cooperation has hardly been optimal. There seems to be a remarkable potential for improving cooperation and coordination of such operations.

The rise of global maritime partnerships is an opportunity to explore a more concerted international approach among like-minded nations towards the apportionment of missions on a regional basis, the sharing of tasks and best practices, the provision of mutual operational and logistic support, the exchange of information in support of law enforcement at sea, and the conduct of combined training and exercising. Cooperating regional security regimes are likely having a vital role in further concept development in the *maritime domain*.

Also from a NATO perspective maritime security is an important and suitable area for cooperation with partners on a global scale. Maritime experience teaches the value and necessity of a *comprehensive approach*, fostering enduring relationships with relevant national and international actors in the maritime environment. NATO's Maritime Strategy⁷ identifies four roles of NATO's maritime forces: deterrence and collective defence; crisis management; cooperative security – outreach through partnerships, dialogue and cooperation; and maritime security. As part of broader efforts to address security threats arising in the maritime environment, NATO maritime forces can contribute to the maintenance of a secure and safe maritime environment given their unique capabilities and routine blue water activities. Existing national and international legislation is sufficient to allow Allies to undertake a range of maritime security operations; however, there may be scope for further enhancing mutual awareness and, where possible, operational harmonisation, among national legal authorities and practices.

NATO maritime operations aim at including international and regional organisations, non-governmental organisations, law enforcement agencies, as well as partner and non-partner nations. They are building on deep understanding of respective capabilities and cultures to be effective as well as respect the competencies of each organisation or agency. Getting there requires a high degree of coordination, interaction and training as

⁷ See: NATO, Alliance Maritime Strategy, Brussels 18 March 2011, http://www.nato.int/cps/en/SID-41426331-6494A785/natolive/official_texts_75615.htm (access 24 Feb 2012)



well as a quest for complementarity whenever appropriate. To this end NATO's newer tasks in support of crisis-management and maritime security often involve forward engagement with non-NATO partners, such as Australia, Finland, Japan and Ukraine, the world over.

Also the European Union – in its maritime policy⁸ – aims at approaching all aspects of the oceans and seas in a comprehensive and dynamic manner. The vision is to infuse cohesion and commonality into offshore functions and provide interoperability in the surveillance systems. It aims to safeguard Europeans' lives and interests by enhancing *maritime domain security* through the integration of activities and systems associated with it.

Awareness

Maritime domain security relies on the ability to build a comprehensive awareness of maritime activity, which encompasses territorial and international waters, and to act accordingly.⁹ Although it is still in the developmental stages *situational awareness* is the prerequisite of *maritime domain security*. Today technological developments such as space-based systems, over-the-horizon radar, and near-shore and harbour acoustics can be incorporated into a layered approach to increase security. To identify and address weaknesses in the system, industry and academia have been discussing ways in which technology, based on advanced modelling and simulation tools can be used to identify threats and determine potential impacts.

The purpose of *maritime domain awareness* is to generate actionable knowledge for the *maritime domain*, i.e. the collection, fusion and dissemination of intelligence and information drawn from armed forces, government agencies, international coalition partners and forces, and commercial entities. The quantity and depth of information collected from these various sources need to be fused to enrich a *common relevant operating picture* that can be – role-based – distributed among relevant users.

A role-based approach, rules and workflow modelling structures enable situational awareness environments to push information to stakeholders within and across organizations while ensuring the security of the information. The role-based approach ensures that stakeholders are able to communicate through a variety of means and maintain role-focused situation awareness throughout the organization and among organizations – many are looking at different situational pictures, but all look into the same situation with a common shared situational awareness.

Through the *common relevant operational picture*, specialists will eventually be able to

- monitor vessels, people, cargo and designated missions, business and logistical processes, areas of interest within the global maritime environment;
- access all relevant databases; and
- collect, analyse and disseminate relevant information.

⁸ European Commission, Integrated Maritime Policy, http://ec.europa.eu/maritimeaffairs/policy/index_en.htm (access: 24 Feb 2012)

⁹ U.S. National Plan to achieve Maritime domain Awareness for the National strategy for Maritime Security, October 2005 http://www.dhs.gov/xlibrary/assets/HSPD_MDAPlan.pdf pg. 1 (access: 24 Feb 2012)



Maritime domain awareness consists of three key components: data, information and knowledge. These components are integrated to create a substantive, layered presentation of the global maritime environment. Particularly the timely fusing of maritime information is an initial priority. Obviously, there are many sources of information, from open source *white shipping* such as AIS¹⁰, commercially available databases such as Lloyds, to comprehensive Intelligence *fused* pictures, representing national, and coalition interests. Incremental gains in information sharing allow for operational co-operation to develop as mutual confidence builds.

When situation awareness is critical, information must be constantly and clearly shared. Sharing information is absolutely essential in order to effectively detect, identify and track the most dangerous threats, including terrorists, WMD, narcotics, piracy, mass migrations, and arms traffickers. Communities and stakeholders need to distribute information internally and across organizational boundaries. Without actionable intelligence, counterterrorist or maritime law enforcement operations are seldom fruitful. Shared information is stored in role-specific queues and takes a variety of forms, such as system alerts and notifications, e-mail based alerts, workflow acknowledgement requests, chat and instant messaging, situation reports etc. In many cases, information can be shared directly from the user interface with a simple drag-and-drop.

Simple and intuitive user interfaces are critical to the success of any security management platform. Users must be able to process whatever information a system generates and displays. Situation information needs to be displayed clearly and without ambiguity. The information must be easily recognized, understood, and ultimately, acted on. Visual user interfaces add tremendous value. The result focuses users on situation anomalies by providing what is important, to the right person, at the right time.

How can collaborative situation awareness be achieved? The answer is multi-faceted and needs to consider the needs of the entire operational domain – geographically and inter-organizationally. For an inter-agency approach to work *maritime domain awareness* must draw together the strengths of the relevant organisations involved in addressing maritime security. In better use of limited resources to address the omnipresent, multi-national security challenges in the maritime domain the output would be most valuable for governments, international organisations and the commercial sector as well. At a tactical level there is a need to build local real time situational awareness via inputs from local sensors: radar, visual, electro-optical and AIS data, enriched with regional information on the inbound tracks. This includes information about contacts of interest in order to generate alerts when they enter a respective area of responsibility. The role of regional and national/international situational awareness centres would be to fuse the pictures provided by local centres. They also receive information collected by priority cueing in order to focus available assets in the right areas.¹¹

Generally, technology platforms need a flexible design to allow the alignment of technology with the organization's processes. Automation coupled with manual overrides and human interaction controls is essential. Overall situation awareness can be significantly enhanced when the manual workload of operators and response managers is removed, allowing them to focus on end-results and decision-making rather than administrative details in the process. With regard to the enormous volume of data generated by the systems and sensors information management is a major challenge. The key to providing true situation awareness is the delivery of

¹⁰ The Automatic Identification System (AIS) is an automatic tracking system used on ships and by Vessel traffic services (VTS) for identifying and locating vessels by electronically exchanging data with other nearby ships and AIS Base stations.

¹¹ See: Allied Command Transformation, Maritime Situational awareness, https://transnet.act.nato.int/WISE/BRITE/TrifoldsofMaritimeSi/file/_WFS/MSA%20Tri-fold.pdf (access: 24 Feb 2012)



contextual meaning, i.e. information including the environment that surrounds it. A threat in one context can be standard practice in another. Adding to the problem is the fluid nature of situation awareness scenarios. The passage of time itself is constantly changing the context of the situation and the information related to it.

Achieving Synergies

It is of key importance for national and international security and prosperity to deal with the global commons in a responsible and farsighted fashion – a fashion that responds well synchronized to common challenges and aims at creating common benefits. The new and dynamic distribution of power in East Asia can lead to two principal developments:

- the onset of confrontations;
- the pursuit of cooperation and mutual benefit.

The earthquake in Japan last year has highlighted the value of cooperation by neighbouring countries and the international community. Shouldn't this inspire serious efforts to overcome tendencies towards a clash of national interests in the region and promote cooperative approaches towards regional stability, security and prosperity and beyond?¹²

The explosion of seaborne trade and the resulting crowding of well-travelled sea routes, choke-points and harbours, together with the rise of illicit activities at sea require fresh thinking – fresh thinking regarding the connections between these diverse geographic settings and risk factors, and a new, comprehensive approach to maritime security. To this end the emerging new security paradigm needs to build on multilateral, collaborative security frameworks providing for a fair sharing of the global commons of maritime and air, cyberspace and outer space – frameworks that facilitate communication between regional nations and provide an effective mechanism that promotes cooperation through increased transparency.

Ensuring *maritime domain security* requires strong and enduring partnerships between civilian and military authorities. These partnerships can build on initiatives already in place and the respective strengths of relevant actors in the domain of *maritime domain security*. Enhanced cooperation is in the immediate interest of any state involved in maritime trade and capabilities are either already existent or can be built up in an international solidary manner. Criminal activities and terrorism could be deterred significantly by concerted action that improves the presence of maritime security forces, enables the boarding of suspicious vessels according to internationally agreed legal rules and provides *maritime domain security* via *maritime domain awareness* and integrated civil-military capacities.

For the maritime domain, the main actors at the national level are civilian authorities, commercial actors and military forces. At the international level, the main actors are global and regional intergovernmental organizations, commercial interest organizations as well as non-governmental organizations. With regard to national/multinational co-operation *maritime domain awareness* needs to create a comprehensive picture of maritime activity based on accessible information. It should cover the deployment of layered maritime security

¹² See: Kim Kwan Jin, Minister of National Defense, Republic of Korea, Asia's New Distribution of Power and its Implications Singapore, 4 June 2011 <http://www.iiss.org/conferences/the-shangri-la-dialogue/shangri-la-dialogue-2011/speeches/third-plenary-session/kim-kwan-jin/> (access 24 Feb 2012)



from the high seas to territorial waters, including littoral areas and port facilities. Security aspects need to be embedded into commercial practices. Co-operation and partnership with commercial shipping agencies will be vital in order to achieve a comprehensive approach to *maritime domain security*, which meets mutually agreed objectives of all parties involved.

Numerous governmental, military and business organizations already possess valuable inputs into shared situational awareness. However, no one source captures all of the maritime information needed or currently available. The information exchange between government agencies and with private industry, in particular, sharing common databases, is the real power behind *maritime domain awareness* centres. To this end I would like to conclude with a recommendation: Why don't we together – South Korea and Germany – start the project of building a virtual situational awareness centre for the purpose of fostering our mutual security and prosperity interests in the maritime domain?!

- Both nations have the professional and technological know-how
- Both nations share global interest with regard to security and prosperity
- Both nations have a significant footprint in the maritime domain

The ultimate goal of *maritime domain awareness* is to identify challenges as early and as distant as possible. This will buy time to determine an appropriate course of action. South Korea and Germany would both clearly profit from such a project – a classical win-win-situation, open for friends, allies and partners to join. A new maritime age is arising – South Korea and Germany have a responsibility to shape its future.

Remarks: Opinions expressed in this contribution are those of the author.

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