

A theoretical framework of Maritime Air Power

by Gjert Lage Dyndal

Abstract

Maritim luftmakt har siden luftmaktens tilblivelse falt mellom forsvarsgrenenes fokus og doktriner. Dette på grunn av kamp mellom forsvarsgrener om innflytelse og makt, så vel som teoretisk og utdanningsinstitusjoners naturlige interesse for enten sjømakt eller luftmakt. Forfatteren argumenterer her for at maritim luftmakt må forstås som både sjømakt og luftmakt. Det foreslås i denne artikkelen et helhetlig teoretisk rammeverk hvor sjømakts-teori legger grunnlaget for å forstå den maritime luftmaktens mål og hensikt. Basert på dette utledes et naturlig sett med kapabiliteter: Informasjonsutnyttelse, overflate-, undervanns- og luftkrigføring, samt styrkeprosjeksjon. Fra disse kapabilitetene, som er varige og robuste, sorteres både varige og nye roller av utøvd luftmakt – avhengig av situasjon og teknologisk utvikling. For å forstå maritim luftmakt er det fundamentalt og vel så viktig å forstå det sjømilitære filosofiske teoretiske grunnlaget som å forstå den tekniske og taktiske utøvelsen av luftmakt, og vice-versa.

MARITIME AIR POWER developments have from the earliest days of air power history fallen between the focus of the navies and the soon developed air forces. Already from the beginning the communities separated, where air power enthusiasts argued the supremacy of air power, for the sake of creating independent services. Due to the early separation there has hardly been developed a theoretical common understanding between the air power and sea power theorists. Still today, we find ourselves with a clear gap with regard to a cross-service body of literature and thought between naval and air force researchers, strategists and philosophers. There exists great volumes of sea power literature on theory, as well as some on air power, although few but any on the intersection. Ben Laite's book *Maritime Air Operations* from 1991 is the closest to be regarded as a theoretical

framework of maritime air power, but it clearly has its shortfalls and the perspectives put forward there need to be widened. Most obviously, Laite disregards the elements of naval air power in his approach to and understanding of maritime air power, which I will argue against in this article. Geoffrey Till's monumental book *Sea Power* partially discusses the issue, but only indirectly deals with maritime air power as his main and wide perspective is on sea power in all its width. The same goes for Ian Speller with his book *Understanding Naval Warfare*. Other literature, which is more explicit on air operations in the maritime theatre, is either empirical or includes historical case studies, and does not place this in a wider theoretical framework. This article aims at nothing less than creating a practical theoretical framework for the subject of "maritime air power".

What should then such a framework, across the naval and air services, constitute? As there are few who have dealt with this exact issue before, the methodology will necessarily be explorative and philosophically theoretical in its approach. By the very term “maritime air power” we see that this is fundamentally about the maritime domain, and thus should be founded in sea power theory. We need to appreciate and understand sea power theory. However, it is also air power applied – with the principles, qualities and limitations of air power included. This gives a framework for the discussion towards a theoretical framework.

The article argues for a broad and three-level understanding of maritime air power based on an acceptance for sea power theory for developing *maritime objectives*, followed by a defined level of *core capabilities* and finally a fluctuating set of specialized *roles* for applied air power in the maritime environment. Understanding and accepting the link between the roles of air power and their maritime rationale is crucial for understanding maritime air power.

As the basic foundation is sea power theory, a discussion of central terminologies and conceptual understanding of established thinkers is necessary for appreciating the objectives of maritime air power and for framing the development of some core capabilities for a theoretical framework. This first part is a theoretical discussion. The proposed and structuring of capabilities and roles derives from this basis. The following discussion of specialized roles are, however, original and based upon own practical maritime aviation experience, research and lecturing. Throughout the discussion, I will mainly use the British debates and contemporary doctrines as case-studies and examples, as the long British history of inter-service rivalry and organization of a maritime air force and

naval forces makes their challenges relevant for both smaller and greater nations with maritime interests. However, the article aims at meeting a wide international audience, as this classic challenge is equally relevant to most nations and armed forces.

Defining Maritime Air Power

In the British case, the *Joint Doctrine Publication* (JDP 0-01, fourth edition), the *British Air and Space Power Doctrine* (AP 3000, fourth edition) and the *British Maritime Doctrine* (JDP 0-10) should provide a knowledge base for students, sailors and aviators. The British doctrines, professional practice and academic discussions provide a great case study relevant to most nations due to its reasonable size of armed forces and air power capabilities in all services. However, even these contemporary doctrines largely fail to adequately explain maritime air power and the intersection between the naval and air forces. The British AP 3000, for instance, avoids defining maritime air power, and jumps straight into the roles of anti-submarine warfare (ASW), anti-surface warfare (ASuW) and Aerial Mining.¹ Is there not more to be said for maritime air power than these few specialized roles?

The British Maritime Doctrine neither gives a definition nor a thorough description of maritime air power. The maritime doctrine states that “the military dimension of maritime power is delivered primarily by the Royal Navy, supported by the British Army, the Royal Air Force and other elements...”² At least in the former maritime doctrine of 1999, the introduction made a point of the fact that: “An airforce fighter ... may well be components of a maritime force because the word ‘maritime’ refers to the environment in which they are operating, not to that

institutional part of the UK's armed forces that might be providing them.”³

From the dispersed understanding of and great span between different definitions, “maritime air power” might be summed up in the following perspectives:

One often used perspective is the naval organic aircraft category often expressed by navies, which by the naval heritage and physical integration and interaction is obviously an important part of maritime warfare. *Organic aircraft* is a common and international naval term meaning *sea-based* aircraft, including anything from combat aircraft from carriers to light helicopters and unmanned aerial vehicles (UAVs) operating from the deck of ordinary surface ships. This is most correctly labelled *naval air power*. The old British Naval War Manual from 1958 and 1961 stated: “The adjective ‘naval’ is reserved for matters which are the exclusive concern of the RN (e.g. Naval Discipline, Naval Establishment)”.⁴ Naval air power would consequently involve all air-assets and operations that are owned, administrated, executed and commanded by a navy. On the other hand, a great deal of the contemporary carrier-based naval air power, specifically naval force projection by the use of air power, should be understood as solely *air power* in many cases, and all theories and principles for air power in general should prevail. There is no point in describing separate theories for different types of aircraft – depending on the take-off and landing platform. A naval combat aircraft operating over, for example, Afghanistan uses the same concepts and is commanded by the same structures as its air force counterparts.

The second perspective states that maritime air power is “land-based air power operating at sea”. This perspective is well exemplified by Laite’s book *Maritime Air*

Operations.⁵ The book was published in 1991, but is still relevant as it is one of the few that discusses maritime air power in a conceptual and theoretical framework. However, the definition of “maritime” made by Laite is evidently based purely on the (then) British organization of forces, and the trends of the Cold War. “Maritime air operations may be defined as the activities of land-based, fixed wing aircraft in pursuit of a nation’s military policy, strategy and tactics at sea”.⁶ He separated maritime forces as land-based, as opposite to the naval seaborne forces. This has classically been, and still is, an often expressed view. However, it should be irrelevant where the aircraft are based – it should be about their purpose.

A third meaning of maritime air power, which is argued for in this article, is about all aspects of air power applied in the maritime theatre. Even though it is hardly the understanding you will get from reading doctrines, this is a view shared by many military thinkers, for example Till where he states that: “Maritime airpower includes land-based airpower intended essentially for maritime use whether ‘owned’ by the navy (as in case of Japan and the US) or not (as in the case of Britain)”.⁷ There are also some useful articles by Till, Richard Mason⁸ and Alan G. Hicks⁹ which include both land-based and naval air power in their perspectives on maritime air power, but these are too short to give an insight into its complexity.

This broader understanding of maritime air power is the focus of this article. Whether the air asset is organic (sea-based) or land-based, administered and commanded by the naval forces or an air force – the “mission objectives” are what defines the application of air power as maritime air power. Consequently, the broader understanding is clear but there is a lack of a concise definition of maritime air power. From the above

perspective, a cross-service, inclusive and descriptive definition of maritime air power would be:

Maritime air power constitutes the parts of air power which are being applied in the maritime theatre to fulfil maritime objectives, as well as achieving the necessary degree of air control for maritime operations within this area of interest.

By this understanding, we notice that to the extent that there exists a theory of maritime air power, this is – or should be – based on sea power theory. However, it is air-power applied and thus a theoretical framework must deal with and accept the qualities and limitations of air power. This requires lecturers and students, aviators and sailors involved in maritime air operations to understand the nature of both air and sea power and warfare to be able to understand maritime air power.

The Maritime Objectives

A Sea Power theory foundation

Sea power is a concept that is hard to describe. Some of the reason may be that it has been a central part of warfare and international relations for centuries, long before the theorists who largely defined the contemporary language of naval warfare in the late 19th Century. Many have tried to define it, and some have tended to avoid it. These never-ending circles have probably led to the various ways that the terminology of sea power has been understood. According to Andrew Lambert, historians tend to discuss sea power as cultural realities of historical studies, while strategists and political scientists are concerned with the utility of sea power rather than its meaning.¹⁰ Lambert argues that we have seen a shift from debates of Command of the Sea,

which largely dominated from the 1890s till the end of the Cold War, to an increased focus on power projection due to the fact that the West has largely been involved in such strategic challenges over the last two decades (e.g. the Balkans, the Middle East and Afghanistan). We may expect that discussions on Command of the Sea will re-emerge as the world again becomes more militarily multi-polar. However, it seems clear that there are some enduring elements of sea power including both *commanding the sea* and *using the sea for greater purposes*, and it is thus necessary to understand these two greater lines of thought.

The terminology *Command of the Sea* (or *Mastery*) has been a central part of maritime military literature for more than a century. Alfred T. Mahan is seen as a representative for a fight for Command of the Sea, and well known for his belief in the “decisive battle” as the main tactic for achieving this aim. Julian Corbett was in contrast to Mahan not so much occupied with the thought of Command of the Sea as that of “communication”. Even though Corbett is viewed as a counterpart to Mahan’s stress on Command of the Sea and the decisive battle as the means – Corbett did appreciate it. He stated: “First, there is the general recognition, always patent to ourselves, that by far the most drastic, economical, and effective way of securing control is to destroy the enemy’s means of interfering with it”.¹¹

Corbett argued that the use of the sea – what he called “communication” – was the object of naval warfare. He argued that with safe communication as the sole purpose, the fundamental requirement was the means of exercising sea control for being able to use the sea.¹² Raoul Castex also noted the importance of communication: “...(when) communication is open, this permits a dou-

ble action, economic and military, against the enemy.¹³

Mahan and Corbett are viewed as the most significant classical writers on sea power, and their main works should therefore be read by any student and reader interested in maritime military affairs. However, it may be challenging as they both wrote extensively and then naturally expressed views in one context which may be the opposite in meaning in another. Many have since been influenced by Mahan and Corbett and applied the general thoughts in their context and time, and may thus be just as good a starting-point in the discussion of central topics of sea power theory, and the constantly discussed term “Command of the Sea”.

Till, maybe the most reckoned with sea power theorist of today, argues that Command should be understood in a relative sense and introduced the term “...degree of Command” some years back.

Being in Command of the Sea simply means that a navy, in that happy state, can exert more control over the use of the sea than can any other. The degree of Command varies greatly and is primarily illustrated by the extent to which it confers the capacity to use the sea for one’s own purposes and prevent the enemy from using it for his. Command of the Sea is about the use of the sea, not its possession.¹⁴

Till argues in his latest edition of “Seapower” that: “... the value of commanding the sea lay not in its physical conquest or possession...”, and he continues stating: “If maritime strategy is about the use of the sea, then commanding it means you can use it for your purposes and prevent the enemy from using it for his”.¹⁵ These overall perspectives are in line with Corbett and are not much disputed today. However, is it useful to use the terminology “...degrees of

Command”? Or is it, rather, a cultural phenomenon or a state of affairs one arrives at as a result of a general capacity to use and deny others the use of the sea? With this, we touch a subject that has been at the centre of many discussions on sea power (as well as air power) about control versus command. One of those trying to clarify the difference is Bernard Brodie, arguing that Command of the Sea is something different than a complete degree of sea control. Command of the Sea is that state where one can use the sea for own commerce and to stop that of the enemy. One may well suffer losses, but nothing so serious that it will be decisive. Like Till, Brodie clearly thinks of Command of the Sea as a relative term, and ends by stating that he “...prefers to speak only of control”.¹⁶ He further argues: “Sea power is the ability of states to secure, deny and exploit the seas for military and political purposes, in war and peace – the destruction of the enemy fleet was just one means by which these tasks were accomplished, not the sole object of maritime forces”.¹⁷ These perceptions by Brodie stand out as a very including, sound and useful description of sea power.

Much discussion has been on sea control. Castex was actually more occupied with those nations that were not able to seek out the enemy for any large or decisive battles. His answer was to build a navy on the maritime strategy and tactics of *manoeuvre*.¹⁸ This included naval raids on enemy communication and less capable ships, the uses of mines, and amphibious operations. He constituted clearly an alternative to Mahan and those in favour of the decisive battle. His thoughts are very important for the medium and smaller powers that face superior forces. Castex’s theories also leads one into the arms of Sergei G. Gorshkov. Early Soviet

strategies (prior to the Second World War) have been paralleled to the principles of the French *Jeune Ecole*¹⁹ tradition of the late 19th Century, followed by a classical large-ship build-up under Stalin, and finally the new thoughts of Gorshkov. The period from the late 1950s till the early 1980s saw a build-up of an alternative but impressive navy focused around submarines and long-range air power, supported by the surface fleet. In this sense, Gorshkov promoted much of the same fundamental ideas as Castex. Gorshkov built naval and maritime air forces for manoeuvre and sea denial.²⁰

To conclude, I support the notion that one should understand Command of the Sea in a relative sense. This in line with Brodie, Castex and Till – who are all easily traceable back to Corbett’s thinking. It is not about possession, but about achieving a situation where one safely and effectively can use and exploit the sea for all own purposes, both militarily and commercially. As Brodie says: “Command has never meant control which was either complete in degree or unbounded in maritime space”.²¹ Based on this notion, Command of the Sea cannot be a concept or aim of any naval forces – as it is, rather, a relative term one may use of a supreme sea power that is unchallenged on the general use of the sea. This is as Lambert argues in his historian’s perception of sea power as a cultural phenomenon. For instance, the US Navy today may say that it has Command of the Sea by the fact that it can secure and use the lines of communication, maintain safe sea basing for force projection – and at the same time deny most opposing forces use of the sea in those areas they define. At the same time, it is important to note that they in many cases will hardly achieve full control of the littorals.

From general Sea Power theory to concrete Objectives

As we experience that Command of the Sea is not a concept or something one will be able to break down for applicable strategies or concepts, practical sea power boils down to the principles that enable the delivery of effects *at sea* and *from the sea*, which in turn are the foundations for those aspiring to maritime power, and possibly Command of the Sea.

At sea: Sea Control – always to an accepted risk

In contrast to Command of the Sea, which has just been argued to be understood as a relative term, Sea control differs by the fact that it is a definable and achievable aim of a military commander. Sea control is limited in both *space* and *time* – and must be safeguarded at all times.

The latest British maritime doctrine states: “Sea control is the condition that exists when there is freedom of action to use an area of the sea for one’s own purpose for a period of time and, if necessary, deny its use to an opponent”.²² It further refers to the NATO Allied Joint Publication 3.3.3 Air Maritime Coordination doctrine stating: “Sea control depends upon control of the surface and sub-surface environments (including the seabed) and the air above the area in which sea control is required”.²³

Consequently, it must be reckoned that sea control has two fundamental dimensions:

- First, control is about *denying* the opponent from effectively using the defined area for his purposes and to interfere with one’s own use of the sea. (Sea denial may also be an objective in its own right. This is discussed in next sub-chapter).

- Second, control is about *safeguarding* own operations, military as well as commercial, to an acceptable risk level. This includes all the dimensions of subsurface, surface and air.

Sea control includes blockade and barrier operations, as well as embargo and interdiction operations. This concept of control is offensive in nature, where one part has an aim of securing a defined area and uses his forces actively to expel or direct the opponent. The aim of area sea control is extensive and will require both great and balanced fleets – still, this condition is not unlikely to be achieved by any major power over a weaker opponent. Today, with the introduction of readily available smart munitions, with short to long range, precise satellite navigation and communication, stealth and computer technology, area sea control may well prove hard to achieve in a conflict between greater powers. Till argues: “...having control of great chunks of the world ocean does not necessarily mean controlling the littorals. Finally, the world’s smaller navies may be able to mount asymmetric challenges to the larger ones, and may eye each other in distinctly traditional sea control terms.”²⁴

In case of more local sea control aspirations, such as for the protection of offshore installations, ports and inlets, as well as the protection of Sea Lines of Communication (SLOC) by convoying and escorts, they are different in nature. Concepts of local sea control become less extensive than area sea control, as this does not necessarily aim at denying the enemy the use of the sea for his own purposes – it is, rather, about safeguarding own defined forces and activities.

Sea Denial

An objective of *sea denial* has classically been the preferred concept of land-powers or smaller maritime nations. If one is not able to secure the necessary degree of control, or finds the cost too expensive or unnecessary for the greater strategies, one should limit oneself to a strategy of sea denial.

The latest British Maritime Doctrine defines sea denial as: “...when one party prevents an adversary from controlling a maritime area without being able to control that area oneself”. The purpose is to place an “unacceptable level of risk to enemy surface units”.²⁵

Sea denial is the most likely maritime objective possible to achieve solely by the use of land-based air power and weapons systems. Air power may effectively deny an enemy to freely use the sea for his own purposes. This was a definitive concept of the Soviet maritime forces from the 1960s onward – and was one of the main factors of NATO’s, Great Britain’s and the USA’s strong interest in keeping northern Norway out of the hands of the Soviet Union. With a Soviet grip on northern Norway, it would have had full access to use long-range land-based air power (with their emphasis on missile technology) against naval surface forces, as well as directly against the British Isles and opening a flank to northern continental Europe. This was a Soviet strategy of sea denial against the naval forces, rather than aiming for any positive degree of control of the Norwegian Sea, the North Sea and the northern Atlantic Ocean.²⁶

Then and today, nuclear submarines and long-range aircraft with missiles are the most potent systems for sea denial on the blue oceans. Surface forces may also be part of the forces used in a concept or strategy of

denial, but in this case we are soon in the grey areas where in reality one is fighting for a degree of control. For the littorals, land-based air power, missile systems, conventional submarines and mining are common sea denial forces. For concepts and objectives of sea denial, the main purpose is to pose such a threat that it will be unacceptable for the opponent to carry on.

From the sea: Power Projection

Power Projection from the sea is also an important element of sea power and warfare.²⁷ Strategic power projection, applied by military forces as “force projection”, has ranged from naval bombardment against targets on land – to full-scale invasion in amphibious warfare. Today this may also include the global reach of both conventional and nuclear long-range smart munitions, as well as organic air power. The British Maritime Doctrine defines that:

...maritime power projection is the threat, or use, of national power at a range from the UK mainland to influence events from the sea. It exploits sea control and maritime manoeuvre to achieve access in order to threaten or project force ashore using a combination of amphibious forces, embarked aircraft, land attack weapons and special forces.²⁸

The doctrine further states that maritime force projection is fundamentally proactive, although not necessarily offensive. It also includes the roles naval forces have of withdrawing forces or civilians ashore.²⁹

By the definition of maritime air power based on maritime objectives outlined in the beginning, force projection against naval assets and infrastructure on or by land should also be defined as maritime air power. However, force projection for influence on the land war will not be a part of mari-

time air power – though still be clearly defined as naval air power.

Thereby the Objectives of Maritime Air Power

Maritime objectives are the concretization of sea power theory. Using the British as a case, their maritime doctrine defines three “strategic principles” that are clearly based on classic sea power theory, doctrine and tactical teaching. These strategic principles, which may also be defined as the enduring, or at least robust, maritime objectives includes *sea control* and *sea denial* for concepts relating to the use of maritime (air) power at sea. In addition, sea power is about using maritime power from the sea. *Force projection* is an important naval objective, and air power often plays a crucial part. However, this objective should be limited to amphibious warfare and tactical strikes against naval forces and support facilities in the case of maritime air power. For ground-attack exceeding the imminent maritime facilities, such as docks and naval infrastructure, the theories or concepts are already well described by existing air power literature and doctrines. This is a natural crossing-line between maritime air power and air power theories in general.

These “strategic principles” and maritime (air) power objectives have been essential since the early days, and are still with us. They are prerequisites for and include all the concepts of a more descriptive nature as littoral access and force protection, barrier and blockade operations, embargo and containment, convoying and escort, and fleet-in-being, etc. These concepts, are variants of the enduring objectives, evolved to describe trends in the military and political state or focus of the time, but often in time disappear or give place to new con-

cepts. The contemporary application of sea power is well discussed in Till's *Seapower* and Speller's *Understanding Naval Warfare*, and those books should be a natural starting-point for any students or readers also of maritime air power.

Based on the British Maritime Doctrine and the sea power theorists we may summarize that maritime operations include all forces and capabilities that may contribute to achieve the grand ideas of Command of the Sea, but foremost the more concrete and defined objectives of sea control and sea denial, as well as the ability to project power from the sea. It is also clear that maritime operations range from peacetime operations to operations in times of tension and war-fighting. These elements may be placed under an umbrella of two main dimensions of sea power: first the aim for *a degree of sea control (or denial)* and secondly *power and force projection*.

Defining the Core Capabilities and (specialized) Roles

The Evolution

From the early days of aviation, the military explored the use of these modern and potential platforms – the new aircraft – for support of the commanders on land and at sea. The first and quite obvious role of the aircraft was to scout for enemy forces, both for surveillance of the battlefield, the coastlines and defined seas of the maritime theatre, as well as for directing fire-power from land-based and seaborne artillery. Also, but to a lesser degree, the aircraft were used for delivery of small bombs or grenades at the enemy. Still, reconnaissance and surveillance must be recognized as the first and primary roles of military aviation. Soon aviators needed to think

about the “fight” for controlling the air, both for being able to use it for their own purposes as well as denying the enemy to use it for his purposes.

After the First World War, theories evolved around the strategic effect of air power. The prospects of air power mobility could be used to avoid the static situation of the main battlefronts between the industrialized great armies. In British, Italian and American army communities the thoughts of “strategic air power” won influence. In the Russian and German armies the use of aircraft in support of the existing land forces became the primary focus. Among the greater maritime powers “floating bases” – aircraft carriers – were developed. These ship-based aircraft first had a reconnaissance role, but were soon able to conduct attacks on naval surface forces. Aircraft in use against surface forces matured and proved effective during the Second World War. Great examples are the many battles of aircraft carriers at sea throughout the war in the Pacific; the hunt for the German cruisers and battleships by both land-based and carrier-based maritime air power forces; the British decisive attack on the Italian fleet in Taranto of 1940 and of course Pearl Harbour of late 1941. As an answer to the evolving submarine fleet, especially that of Germany, land-based aircraft were also put into the role of hunting and destroying submarines with great success. During the Second World War, the aircraft made its permanent entry into the maritime theatre.

Maritime air power became crucially important for reconnaissance and surveillance for the naval surface forces, as well as for fighting surface battles and hunting submarines. In addition, it was recognized that the fight for controlling the air domain, or at least for self-defence, was a prerequisite for all naval forces. Maritime air power had

set its position, but there ensued extensive political arguing on organization, development and fighting for control of the air assets. This has since restricted the evolution of maritime air power theory and conceptual developments. As noted, there hardly exists complete and thorough descriptions of maritime air power, be it theoretical or doctrinal, at least one that has been adopted by naval and air forces and philosophers.

Doctrinal discussion of Capabilities and Roles

According to the latest British Air and Space Power Doctrine there are three roles of maritime air power: *Anti-Surface Warfare (ASuW)* and *Anti-Submarine Warfare (ASW)*, and *Aerial Mining*.³⁰ However, in studying sea power, there is obviously a greater variety of roles played by air power in the maritime environment. The magnitude may be lost if we do not define the roles air power should play in relation to sea power theory, concrete maritime objectives and core capabilities.³¹ As maritime air power theory and concepts are not defined, there is neither a directly useful defined terminology which naval and air force literature has agreed upon.

The contemporary British Air and Space Power Doctrine defines a set of “fundamental roles”, and introduces the term “specialised roles”. The air force understanding of “fundamental roles” includes *Control of the Air and Space*, *Air Mobility*, *Intelligence and Situational Awareness* and *Attack*.³² The specialized roles of air power are subordinate to the former. And for maritime operations, the doctrine only defines three of them as earlier noted: *Anti-Surface Warfare*, *Anti-Submarine Warfare* and *Aerial Mining*, which is clearly an inadequate description of maritime air power.

What are then the equivalent naval terms and understanding? The contemporary British Maritime Doctrine uses the term “role” in a different way from that of the air force, with an overarching three-level split of the doctrinal roles of *War Fighting*, *Maritime Security* and *International Engagement*.³³ This article limits the discussion to the more classical roles of warfighting and maritime security. At a more practical level, and more paralleled to air force doctrinal thinking and its use of the term “fundamental roles”, it is for naval concepts and tactics common to organize and think in terms of “warfare areas”, such as *Surface*, *Subsurface* and *Air Control Warfare* for the capabilities relating to sea power concepts and tactics *at sea*, and the core capability of *Force Projection* in concepts and tactics *from the sea*. In addition, for the ability to build and maintain a good situational awareness, various roles of *Information Exploitation* are recognized as a crucially important capability that air power plays for the maritime forces.

Towards a common cross-service understanding

As we see, there is no mutually agreed upon and established set of capabilities (or whatever one chooses to label it) and roles of maritime air power. There are disagreements across the service doctrines, and even internally the naval and air force doctrines have changed their definitions and terminology for each revision of the doctrines.³⁴ The aim of this article is to try to bridge this disagreement. As sea power theory and maritime objectives define the strategic purposes, it is also natural to develop this into core capabilities more resembling the naval tradition. The specialized roles are derived from both naval and air force communities.

However, the main point here is not to create a new set of terminology, but most importantly to define a functional three-level comprehensive understanding where: (1) sea power theory and *maritime objectives* lay the foundation, (2) the term *core capabilities* describes the overarching and enduring capabilities – often joint – of maritime power, and (3) the *specialized roles* includes the tactical and technical air power roles applied. These specialized roles tend to come and disappear as strategic challenges change from scenario to scenario and over time, both due to political and geographical conditions, and not least as a consequence of technological developments.

Consequently, what we may define as the core capabilities of maritime air power includes: *Information Exploitation, Surface Warfare, Air Control Warfare, Subsurface Warfare* and *Force Projection*.

After defining this set of core capabilities of maritime air power, it is possible to methodically define and sort the “specialized roles”, where a “role” describes the specific purpose of a unit in military operations. For instance, subordinate to the core capability of Subsurface Warfare, we will find the applied roles of Anti-Submarine Warfare, Mine Warfare and Mine Countermeasures

operations. New roles, subordinate to the core capabilities, may well arise or disappear with different scenarios and technology. In addition, there might well be other forces in supportive roles, e.g. Electronic Warfare (for example jamming) support within the role of Anti-Surface Warfare.

This separation of *core capabilities, specialized roles* and even *supporting roles*, as separate levels are important for not losing sight of the span of maritime roles. Too often maritime air operations are simply divided into ASW and ASuW, which are only two out of all the important roles of maritime air power. This is the pitfall if one does not first describe a supreme level of core capabilities. As mentioned, this is an apparent problem in the contemporary British Air and Space Doctrine (and many other air force doctrines), where it fails to mention many of the actual roles air power plays in the maritime domain.

The span and complexity of core capabilities and specialized roles of maritime air power may be visualized in the following model, where the core capabilities are robust and enduring, and the specialized roles are more fluctuating as scenarios change and technology evolves:

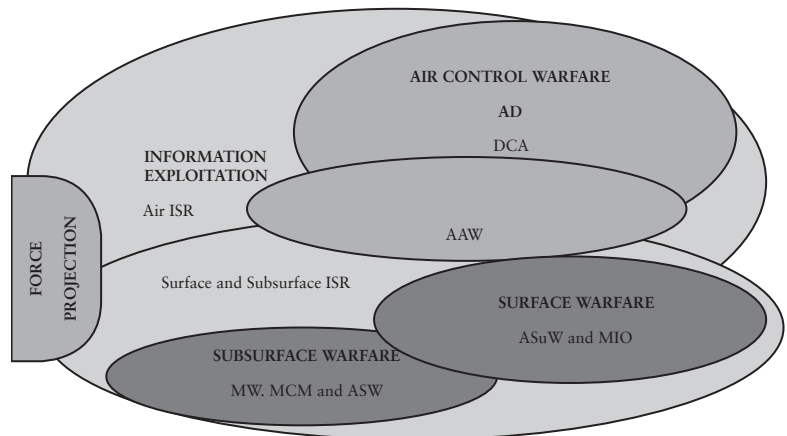


Figure 1: The five Core Capabilities and the contemporary Specialized Roles of Maritime Air Power.

Describing the Core Capabilities and (specialized) Roles

The first Core Capability: Information Exploitation

The first core capability – *Information Exploitation*, includes the specialized roles of intelligence, surveillance and reconnaissance. This capability with its three roles is important for all dimensions of warfare, both for the success of most tactical missions and for the greater operations and campaigns. Information Exploitation includes the process of collecting data, as well as the evaluation and fusing of the information for achieving an integrated intelligence picture. In contemporary writing and concepts this is often referred to as *ISR* – Intelligence, Surveillance, and Reconnaissance.

Intelligence operations range from the lower tactical levels to the top political level. As for maritime air forces, they are constantly involved in roles of intelligence gathering. Military intelligence must truly be stated as a necessity for military and state power. By holding the relevant information and making the correct evaluations, the strategic decision levels are able to take the correct actions. These will in most cases stop conflicts before the parties commit themselves to unnecessary military confrontation.

Surveillance means systematic observation of all the dimensions of cyber, space, air, land and sea (both surface and subsurface). Maritime theatre surveillance includes the surveillance of all activity that would be inflicted on the maritime theatre. Surveillance is conducted and compared over a period of time. The maritime core capability of Information Exploitation also includes the

surveillance of the air dimension. For air surveillance and early warning, both land-based and seaborne aviation, as well as surface ships are important. Contemporary Airborne Early Warning (AEW) also includes command and control capabilities and responsibility.

The third role within Information Exploitation is *Reconnaissance* and this is about obtaining information on the *positioning, activities and resources* of an opponent. This level of information gathering is more local in both time and space than surveillance. Reconnaissance is basically all spot-observation, and an integrated part of most activity at the tactical level. Surveillance, as well as reconnaissance roles performed by air power, are perhaps some of the most significant ones for the naval surface forces. In maritime warfare the reconnaissance role gives invaluable inputs to the Recognized Maritime Picture (RMP), which includes the subsurface, surface as well as the air dimensions.

Today the ISR roles of maritime air power, both with greatly enhanced sensors, effective space-systems and a rapid introduction of new unmanned aerial systems (UAS), have dramatically changed the tactics and concepts of maritime warfare. To a great extent, no naval surface forces are able to operate concealed – not even the “stealthy” vessels. However, asymmetric surface forces, for example small civilian vessels loaded with explosives or armed with small but sophisticated missiles, and piracy from fishing vessels still pose great challenges to maritime forces.

Finally, it is important to realize that all the elements of Information Exploitation are integrated in and make up the foundation for the three following core warfighting capabilities of Surface, Subsurface and Air Control Warfare for securing sea-basing.

The second Core Capability: Surface Warfare

The second core maritime air capability is *Surface Warfare*. Surface Warfare is about controlling the enemy or denying him the use of the sea, and if necessary destroying his maritime forces and capabilities. Surface Warfare for maritime air forces may be divided into the two specialized roles *Anti-Surface Warfare (ASuW)* and *Maritime Interdiction Operations (MIO)*.

To start with the latter, MIO have to a great extent become the “daily” role of maritime air forces in peace, crisis and limited war operations, especially in the case of organic helicopters and maritime patrol aircraft. MIO encompass seaborne enforcement measures to interdict the movement of certain types of designated items into or out of a nation or specific area, for example smuggling, piracy and drug trafficking.

For the classical warfighting roles within Surface Warfare, they are all embraced by the role of ASuW. The common contemporary understanding of ASuW is that this includes all actions against an adversary’s surface forces or merchant ships in order to achieve sea control or sea denial and to disrupt his sea lines of communication. In littoral waters fast attack boats, which are operated by many nations, may pose a threat to own civilian shipping and naval operations. Due to political as well as navigational constraints, larger warships may not be suited to operate freely in these waters. Fast patrol boats, operating together with larger warships and helicopters, may at the same time offer the best solution to counter this threat. Air power may (and should) in these operations both be tasked for building a recognized maritime picture, as well as for delivering lethal and non-lethal effects of power.

Today, there are three major missile technologies developed for strikes against surface forces. The traditional missiles are widespread, and they are still useful. They are relatively cheap, and may actually strike most targets except for the most modern and larger vessels with effective self-defence systems. Today, hard countermeasures such as anti-air missiles and guns, as well as soft systems as chaff and flares, defend the larger naval vessels. These targets are difficult to strike with older generations of missiles, unless they are launched for a “missile overload” purpose from an attacker or attackers. More modern missiles are either based on low-signature (stealth) to be able to close in on the bigger targets, or are being developed to have multiple times supersonic sprint at the final stage towards the target to penetrate modern defences.

The role of ASuW is crucially dependent upon the roles of ISR and effective targeting to be able to direct the application of force. Non-lethal ASuW includes anything from third-party target-reporting to electronic warfare. Third-party targeting is a contemporary terminology, but the ideas and use have obviously been around since the birth of air power. The spotting and reporting of gunfire has since evolved to include specified procedures for voice over radios, later for link systems and the evolving networked concepts. All types of communication are used for this purpose, and as missiles were designed for long ranges during the Cold War, third-party targeting became crucially important and necessary. Electronic Warfare (EW) includes both offensive and defensive exploitation of the electromagnetic spectrum for the purpose of combat.³⁵ Jamming, an effective role of air power, either aimed at electronics, communication or other, is considered offensive although still non-lethal.

To sum up on Surface Warfare: it is about the all-embracing ASuW concept and MIO for control of the activity at sea. For ASuW, the fleets of aircraft armed with missiles have largely become the successor to the battleships for fighting the surface war.

The third Core Capability: Subsurface Warfare

The third core capability of maritime air power is *Subsurface Warfare*. This core capability classically as well as contemporarily comprises the roles of *Anti-Submarine Warfare (ASW)* and *Mine Warfare (MW)*, including *Mine Countermeasure operations (MCM)*.

Both during the Second World War and the Cold War ASW in the conventional navies became focused on the convoying system. Operations were intended for denying the opponent the effective offensive tactical use of his submarines against one's own forces and shipping. The protection of forces has been conducted by a principle of "defence in depth" and has required close co-ordination between ships, helicopters, maritime patrol aircraft, shore-based facilities and friendly submarines. Additionally, ASW was developed to hunt the nuclear armed strategic submarines that saw the light of day by the end of the 1960s. The force of strategic submarines came to be a dominant part of the Cold War stand-off, and thus ASW became central for fighting these warships. The strategic submarines did not diminish after the Cold war, but have attracted less focus. Today, as the stand-off between Russia and the West has re-emerged, the strategic forces will most likely again come to the forefront of strategic thinking.

Anyhow, over the last decade many smaller nations have been investing in conventional submarine forces. Conventional submarines

are affordable and still pose a great, often strategic, threat to greater nations. Due to the strong focus on land warfare and asymmetric challenges for more than two decades, the expensive and long-term investments in ASW technology and capabilities have largely stopped. As the gap between submarine technology and ASW technology and concepts widens, the classical conventional perspective of ASW as a defensive way of warfare should come to an end. For the limited wars of today and near-future conflicts between asymmetric forces, the greater nations should, rather, aim for an offensive ASW approach. *Offensive ASW* here means operations aiming at finding and neutralizing or controlling enemy submarines before they can constitute a threat. This has to a limited degree existed, not in the main naval concepts, but more as a secret part of the Cold War with the triad of SOSUS³⁶ and intelligence ships in co-ordination with the offensive capabilities of hunter submarines and ASW aircraft. For the last decade, the US Navy has promoted and used a term "hold at risk," which describes and can be used about offensive ASW. A great maritime power today must be able to achieve full control of the limited numbers of submarines of smaller nations. The conventional, smaller, yet powerful submarines pose a significant threat to the greater democratic nations. Not so much as an equal adversary (mainly because of the small numbers) to stop military forces in total, but they might easily overthrow the campaigns or operations, as the willingness of a state or alliance to accept the loss of one or a few of the naval or commercial ships has its limits. In today's global political and media world, the few and small conventional submarines have met with a far greater relative importance – almost strategically. Therefore, the greater nations and alliances should apply

offensive ASW concepts to seek out and control the limited numbers of submarines of their asymmetric adversaries for safe access to the littorals and ensuring a strategic safety of own military and significant civilian shipping. Going out and searching for, and knowing their location at all times for achieving sea control – this is “holding at risk” in offensive ASW. This issue of offensive ASW operations raises the delicate question of pre-emptive actions against a potential capability of another state. If one should choose to neutralize a submarine “held at risk”, this may well be against international law and may also escalate the situation. This should not normally be the option to choose. Offensive ASW, and the concept of “holding at risk” are not necessarily about destroying (in peace or crisis) enemy forces – it is also about knowing the position and status of the enemy. Through the use of maritime aircraft and satellites with long-range cameras and synthetic aperture radars, or human intelligence, one may even achieve control just by detecting the enemy forces in port. If they leave port, deployable surveillance systems, hunter submarines and aircraft must try to maintain contact, and if they do so – the commander at sea does have control of the enemy.

For future large-scale wars between somewhat equal forces in the maritime theatres, one will still probably have to fall back on the defensive perspective of ASW to avoid the threat or limit the submarines’ possibility to operate effectively. The submarine is still a potent and demanding opponent.

Mine Warfare (MW) includes the laying of mines, as well as actions taken to counter the threat of an adversary’s mines. For MW, including *Mine Countermeasure operations* (MCM), organic and autonomous unmanned underwater sensors for detecting mine threats are evolving. For the sur-

face ships, self-protective defensive systems against torpedo-mines are being implemented, but the true capabilities are at best questionable.

MCM may for aircraft involve actions taken to prevent an adversary from successfully laying mines by attacking adversary minelayers and by traditional mine hunting and sweeping. Most nations use surface ships in this latter role while some, especially the US, have extensively used organic helicopters in this mine-clearing role since the Vietnam War. Today the US Navy further explores this MCM role with their MH-60S helicopters using LIDAR³⁷ system for mine search, as well as for shallow water ASW search. For the destruction, the helicopters may use a gun-system of a special precision 30mm supercavitating projectile³⁸ to penetrate and destroy surfaced and near surface mines. The technological company Thales has even developed mine-hunt dipper sonars for helicopters.

Minelaying, or the threat of mining, can either be protective, defensive or offensive.³⁹ *Protective minefields* are laid inside territorial waters with the aim of securing friendly forces or shores. *Defensive minefields* laid in international waters must be announced, and are aimed at restricting or channelling an adversary’s movements. *Offensive minefields* are laid in waters controlled by an adversary in order to force the adversary to take action such as closing ports or re-routing shipping. Aircraft capable of carrying large quantities of mines have been used for mining by many nations. This is an important capacity of maritime air power, though it is seldom talked about. Mine Warfare, especially in the case of minelaying, is clearly an important role for maritime air power, though not too often acknowledged and discussed.

The fourth Core Capability: Air Control Warfare

The fourth core capability, *Air Control Warfare*, deals with the necessary degree of control of the air. This includes the prerequisites of radar and electronic air surveillance, command and control, as well the fundamental fighting capabilities of combat aircraft and surface-based air defence systems from naval ships and land. Both naval organic and land-based combat aircraft have an important role to play for achieving the necessary degree of air control for other maritime forces to function. In the maritime warfare perspective, the approach to air control is in fact defensive. The aim is seldom air control *per se*, but denying all enemy air activity to be able to freely use own submarine and surface capabilities.

The navies and NATO maritime doctrines define the total effort as Anti Air Warfare (AAW), including all defence of friendly forces in the maritime environment against air threats posed by aircraft and weapons launched from air, land, surface, or sub-surface platforms. Contemporarily, AAW is carried out by a principle of “layered defence”: first, by obtaining early warning by passive means such as intelligence and signal interception, as well as long-range air surveillance radars from land, ships and aircraft. The organic AEW aircraft has in the maritime theatre an especially important complementary capability to cover the low-level axis below the cover of the surface radars. After the early warning and recognition cycle, the combat forces of fighter aircraft and long-range missile systems cover the outer defences, complemented by medium-range missile systems. The short-range systems of missiles and guns are for self-defence. This is further complemented by chaff and flare

systems, and in some instances active jammers against incoming missiles. This complete and layered AAW system is still a necessity for ships with reasonable self-defence systems, since even the most sophisticated systems do have a critical “missile-overload” threshold.

It might further be useful to break down AAW into *point air defence* and *area air defences* for getting into discussions on air power. Point air defence systems consisting of guns, short-range missiles and lasers are solely for self-defence of a unit, and should not be labelled as air power. Area air defences are, on the contrary, an important element of maritime air power. Area air defences include integrated medium-range to long-range surface-to-air defence systems, as well as fighter aircraft in the outer area on Combat Air Patrols (CAP) in direct support of the naval surface force. The role and these operations are labelled *Defensive Counter Air* operations by air forces. With all these different roles of air power a commander will try to achieve an effective air defence and a necessary degree of air control or denial, which is crucial for other air and sea operations.

The joint effort of Air Defence – or AAW in the naval case, is interesting for examining the intersection, or crossing-lines, of air and sea power. It clearly includes roles of air power, but it obviously also has a maritime objective for the defence of and as a pre-requisite for all other maritime operations to take place.

To achieve a higher level of air control (*air supremacy* or *air superiority*) over any extensive area in the dimensions of time and space – air power is normally most effectively used in more offensive concepts. We are then discussing the applied air power role of *Offensive Counter Air* operations, such as attack on airfields, aircraft logisti-

cal facilities and suppression of enemy air defences. Arguably, we then move the discussion on use of air power over into *ordinary air power concepts and theory*, and this may be viewed as a natural limit or grey area between sea power and air power concepts, theory and doctrines. We may identify another crossing-line between maritime air power and air power theories and doctrines in general.

The core capability of Air Control Warfare for achieving the necessary degree of air control has been – and will be – a pre-requisite for all conventional maritime forces.

Force Projection – a “fifth” Core Capability

Force Projection is a fifth core capability. It is about using military forces for amphibious warfare and for using firepower attack/strike towards land – perhaps even far inland. It is about using sea-based military forces to actually influence the land war itself. In many cases, this includes no maritime objectives. When discussing operations of Force Projection we often find ourselves in a hazy area of objectives, reason and responsibility between the three military services (and maybe even a fourth part-service, the “Marines” territory). I will argue that some of the operations of Force Projection are within the scope of maritime air power, while others are not.

Effective *amphibious operations* are important for the safe and timely delivery of seaborne forces to a coastal objective. Access to the littorals and coastlines have historical importance, for example, with the landings in Normandy and during the Korean War. Contemporarily, the Iraqi wars are good examples. Great efforts were put into preparation of the landings and ensuring access followed by the landings. This was very im-

portant both for opening a new front and for logistical support by sea. Amphibious operations became less important in the greater Cold War play, but have become the prime focus of the larger maritime forces over the last two decades as navies have largely been unchallenged at sea, and therefore gradually have focused more on strategic concepts *from the sea*. The US Navy went from the Cold War blue ocean focus, last described in their “Maritime Strategy” of 1986, through the doctrines “From the Sea” of 1992, “Forward from the Sea” of 1994, the “Sea Power 21” concepts, and most recently the much debated Air-Sea Battle Concept, in co-operation with the US Air Force.⁴⁰ These offensive force projection concepts all require sea control forces (ASW, AAW, ASuW and MCM) for the defence of shipping and own naval forces.

There is normally talk of four types of amphibious operations⁴¹, which shows the width of this field: “Amphibious demonstration”, “amphibious raid”, “amphibious assault” and “amphibious withdrawal”. *Amphibious assault* is the principal type of amphibious operation, which involves establishing a force on a hostile or potentially hostile shore. *Amphibious withdrawal* of forces by sea has often been used to evacuate political personnel or Special Forces. An *amphibious demonstration* is a show of amphibious force with the purpose of influencing an enemy into a course of action favourable to friendly forces. An *amphibious raid* is a landing from the sea on a hostile, or potentially hostile, shore involving swift incursion into, or a temporary occupancy of, an objective followed by a planned withdrawal. Raids are conducted for such purposes as: inflicting loss or damage, securing information, creating a diversion or capturing or evacuating individuals and/or materiel.

Maritime forces can contribute to *fire-power strikes* against targets ashore using carrier-based strike aircraft, sea-launched cruise missiles, as well as classical naval guns.⁴² In maritime operations, particularly in the coastal environment, air forces work in close co-operation with naval forces to ensure the most effective use of available air assets for air cover and in strike roles. As for the roles of strikes on naval forces by aircraft, these operations are mainly covered in the chapter on Surface Warfare. The cases that differ are when aircraft are to attack naval support facilities and ships in harbour. This strike role, in contrast to strikes against targets out at sea, requires more understanding of air strikes in general: land avoidance, tactical flying for hiding in the terrain, continuous short-range SAM threats, and the targeting itself. During the Second World War, Bomber Command and US bomber aircraft contributed to the maritime war by attacking ships in harbour, production and repair facilities and oil supplies.⁴³ This should be reckoned as maritime air power.

Discussing strikes against targets outside of the immediate naval support facilities and harbours, the theories and concepts of sea power may no longer be best suited to describe all elements and their rationale, even though the aircraft may be operated from carriers. General air power theory and doctrine comes into play. This is another crossing-line between maritime air power, which is about maritime objectives, and general air power concepts. Force projections from ships against targets far inland (e.g Afghanistan) are not about maritime objectives – it is in fact aircraft operating from carriers for purely land warfare objectives. This is, or ought to be, more correctly labelled *naval air power*, which is an administrative and organizational rather than object-based description.

Conclusion: a theoretical framework of Maritime Air Power

This article has had a twofold purpose; first of all to try to define a broad and common perspective on maritime air power, for both students and readers of air and naval services, to understand and accept. Secondly, I have argued for a conceptual framework which takes its basis from sea power theory, but also acknowledges that it is air power which is being applied. Maritime air power is both sea power and air power in nature.

Understanding the elements of maritime air power starts with appreciating and creating an understanding of the *maritime objectives* and then, based on this knowledge, appreciating the two levels of applied air power in the maritime environment, both the *core capabilities* and the applied specialized *roles* of maritime air power. These specialized roles come about and disappear over time, as the strategic framework changes and technology develops. It is essential to appreciate all these three levels to have a comprehensive understanding of this special field of military art, which is both about sea and air power. One can hardly achieve a complete understanding of the operational and doctrinal aspects without a study of the tactical and technical aspects of air power. Similarly, one can hardly understand maritime air power without knowledge about sea power theory and the maritime objectives.

The study of maritime air power shows that it is fundamentally “joint” and thereby it is necessary to take into account the differences in culture, terminology and doctrine. The argument is that maritime air power must be recognized wholly as both air power and sea power. The one- service, sailor or

aviator, student or reader disregarding this has not grasped the subject.

The conceptual framework of *maritime objectives, core capabilities* and (*specialized roles*) is essential. This split in levels is too often overlooked, and thereby one often loses sight of the great span of roles within the field of maritime air power, and their pur-

pose. Maritime air power is so much more than just ASW and ASuW, which is often stated in air force doctrines.

The author is a Colonel and doctor, heading the Department for Military Studies and Doctrine at the Norwegian National Defence College.

Notes

1. British Air and Space Power Doctrine, *AP 3000, Fourth Edition* (2009).
2. British Maritime Doctrine, *JDP 0-10* (2011), p.vi.
3. British Maritime Doctrine, *BR 1806* (1999), p.3.
4. British Naval War Manual, *BR 1806* (1957/1961) (declassified RESTRICTED), p.3.
5. Ben C. Laite, *Maritime Air Operations* (London: Brassey's, 1991).
6. Laite, *Maritime Air Operations*, p.4.
7. Geoffrey Till, "Maritime Airpower in the Interwar Period: The Information Dimension" in *The Journal of Strategic Studies* (Vol.27, nr.2, June 2004), p.322.
8. Richard A. Mason, *Air Power, An overview of Roles* (London: Brassey's Defence Publishers, 1987), pp.101-117.
9. Alan G. Hicks, "Maritime Air Power", in Richard A. Mason ed, *War in the Third Dimension. Essays in contemporary air power* (London: Brassey's, 1986), pp.169-186.
10. Andrew Lambert, "Sea Power" in Georges Kassimeris and John Buckley, *The Ashgate Research Companion to Modern Warfare* (Farnham: Ashgate, 2010), p.82.
11. Julian S. Corbett, *Some Principles of Maritime Strategy* (Annapolis: Naval Institute Press, 1988), p.118.
12. Corbett, *Some Principles of Maritime Strategy*, p.112.
13. Raoul Castex, *Strategic Theories* (Annapolis: Naval Institute Press, 1994), p.41.
14. Geoffrey Till, *Maritime Strategy and the Nuclear Age* (New York: St.Martin's Press, 1982), p.16.
15. Geoffrey Till, *Seapower*, 3rd edition (London: Routledge, 2013), pp.144-146.
16. Bernard Brodie, *A Guide to Naval Strategy* (Princeton: Princeton University Press, 1944), p.91.
17. Bernard Brodie, *A Guide to Naval Strategy* (New York: Praeger, 1965), p.226.
18. Castex, *Strategic Theories*, pp.184-202.
19. The terminology "Jeune Ecole" was introduced in 1884 by Admiral Hyacinthe-Laurent-Theophile. It advocated torpedo boats and fast commerce raiders (Castex, *Strategic Theories*, p.xiv). For a good account of the Jeune Ecole tradition, see Arne Røksund, *The Jeune Ecole. The strategy of the weak* (Boston: Brill, 2007).
20. Gjert Lage Dyndal, "The rise of the Soviet Navy, a re-visited Western view", *KKRVA*, Nr 3 July/September 2013.
21. Brodie, *A Guide to Naval Strategy* (1944), p.91.
22. British Maritime Doctrine (JDP 0-10), pp.2-10.
23. Ibid.
24. Geoffrey Till, "The Royal Navy in a New World, 1990-2020", in Patrick O'Brien ed, *Technology and Naval Combat in the Twentieth Century and Beyond* (London and Portland: Frank Cass, 2001), p.227.
25. British Maritime Doctrine (JDP 0-10), p.2-11.
26. Dyndal, "The rise of the Soviet Navy, a re-visited Western view".
27. Readers will experience for the terms "power projection" and "force projection". The difference is essential, and must be noted. The difference is that "power" refers to the greater strategic outcomes. The term "force" is more useful for the description of applied

- roles of air power. The British Maritime Doctrine labels the total concept as “maritime power projection”. (JDP 0-10, pp.2-14)
28. British Maritime Doctrine (JDP 0-10), pp.2-14.
 29. *Ibid.*, pp.2-15.
 30. British Air and Space Power Doctrine, *AP 3000, Fourth Edition* (2009).
 31. Air force terminology does not cover a maritime air level above the roles of ASW and ASuW. However, the AP 3000 has a good description of the general air power capabilities, and this is a derivation from this terminology.
 32. British Air and Space Power Doctrine, *AP 3000, Fourth Edition* (2009).
 33. British Maritime Doctrine, *JDP 0-10* (2011).
 34. There are no agreed and robust definitions of the various levels of applied air power. Terminology, including definitions and the relationship between the definitions, is constantly changing. This has been the case for British development, as for most other nations. The current US Air Force Doctrine Document 1 (2011 edition, pp.42-43) labels this mid-level as “core functions”, while it previously labelled this as “core duties and responsibilities” and “capabilities”.
 35. British Maritime Doctrine, *BR 1806* (1995), p.213.
 36. Description: The established term SOSUS stands for “SOund SURveillance System” – and provides deep-water long-range detection of faint acoustic signals. The antennas consist of high-gain long fixed arrays. The first detection systems were operational by early 1950s. Downloaded from <http://www.fas.org/irp/program/collect/SOSUS.htm>
 37. LIDAR (Light Illumination Detection and Ranging), laser which detects targets at depths between 5-50 metres, depending on the clarity of the water. This technology came as a ASW search system in the early 1960s, but until the 1990s, component technology has not been capable.
 38. RAMICS (Rapid Airborne Mine Clearance System).
 39. NATO even divides minelaying in strategic and tactical mining.
 40. There are often references to the Air-Sea Battle Concept. However, the main documents are classified. Basically this is a concepts created in the period 2009-12 for meeting the threats of enemies posing anti-access and area-denial challenges to the US global forces. (Philip Dupree and Jordan Thomas, “Air-Sea Battle: Clearing the Fog” in *Armed Forces Journal* (May 2012). Increased use of both unmanned aerial and underwater systems are defined as especially relevant in high-risk areas as the ASBC tries to cope with Daniel Goure, “A new kind of Carrier Air Wing”, in *Proceedings Magazine* (September 2012 Vol. 138), and John Richardsson and Joel Holwitt, “Preparing for Today’s undersea Warfare”, in *Proceedings Magazine* (June 2012, Vol 138).
 41. NATO Allied Joint Publication, *AJP 3.1* (2004), pp.2-23.
 42. Naval guns may again get a renaissance with the evolving technologies. The US 127mm rocket assisted ERGM (Extended Range Guided Munitions) has ranges several times those of ordinary naval guns and are GPS guided. With the evolution of electronic rail-guns with 155mm canons – ranges of 200nm are proposed. This may give the gun-ship a re-birth...
 43. British Naval War Manual, (1957/1961), p.65.