The elements of Maritime Air Power

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Abstract

This Master of Philosophy dissertation is about air power in maritime warfare. I have from academically studies and operational maritime aviation experience found that *Maritime Air Power* has through its short history fallen between the concepts and theories of sea and air power. It has often been narrowly described and defined – often with great differences between the naval and air services. Because of this lack of a common and cross-service definition, I have in this dissertation presented a description of Maritime Air Power based on purpose and objectives rather than viewing it from a perspective of service or platform. The definition argued was: "*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*".

Following this perspective, I have identified and argued all the elements that have to be included. The first element of Maritime Air Power is clearly the greater *maritime objectives*. This is important for the philosophical and strategical understanding. In the case study on the British forces of the period 1957-67, this was a era of great change. Secondly there is a set of elements described as the *core capabilities* of Maritime Air Power. These are *Information Exploitation, Surface and Subsurface Warfare*, and not at least *Air Control Warfare*. *Force Projection* has been reckoned as an important core capability of naval air power, but is not necessarily defined as Maritime Air Power. Within these core capabilities, or warfare areas – the span of practical roles of Maritime Air Power have been identified, and finally applied for the study of the British Maritime Air Power capabilities.

Hopefully this dissertation will contribute to give a *comprehensive perspective on Maritime Air Power* – and not at least contribute to bridge the different perspectives, both on concepts and theories of sea and air power.

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Permission to consult

The dissertation is available to anyone who may have interest of consulting it for his or her own studies on the field of air power at sea. When using the information set forth in the dissertation, it must be noted with full reference including the authors name, as well the University of Glasgow.

Introduction

This dissertation argues that what I call *Maritime Air Power* is an important but neglected concept of warfare, operational as well as doctrinal and academically. It suffers from being both sea and air power in nature. I intend to spend much of my time in the following dissertation creating a cross-service robust definition and description of Maritime Air Power, but for the moment it might – in a preliminary way – be described as the use of air power at sea. My argument is that there are universally recognised theorists of sea power (e.g. Corbett) and universally recognised theorists of air power (e.g. Douhet), but that the concepts exist in different theoretical, historical and bureaucratic spheres. Navies think in term of sea power, air forces think in terms of air power. Naval academies teach sea power, air force academies teach air power. An important factor is which service "owns" the aircraft that operates at sea. In addition these theories or paradigms of sea power and air power argue for the primacy of their subject, air power on its own is the war winner, or sea power on its own is the war winner. Maritime Air Power gets caught between.

The term Maritime Air Power has in the past decades come to mean something rather narrow, e.g. aircraft, especially long-range patrol aircraft like the RAF's Nimrod, operating from land bases, and making a distinction between such forces and carrier- or other sea-based forces. I use the term Maritime Air Power much more broadly, and I feel it is a clearer concept than the widely used "naval air power" – which is actually a more administrative and organisational term. The term naval air power also confuses the issue somewhat, partly because it suggests the use of aircraft "owned" exclusively by a navy (rather than an air force).

This is not simply an arid philosophical or theoretical debate. One of the main issues of inter-service rivalry is precisely which service is going to exert – and get the resources to exert the air power components.

Background

From the very beginning of aviation, the military explored the use of these modern and potential platforms for support of the battlefield commander. The first and quite obvious role of the aircraft was to scout for enemy forces. Both for the surveillance of the battlefront and coastlines of the maritime theatre, and for directing firepower from land based and sea based 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 reckoned as the first and prime roles of military aviation. Soon after this, aviators and theorists started thinking about the "fight" for controlling the air, both for being able to use it for 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. In British circles this was adopted as sound and promising concepts, and the bombers were developed and got a central position. In Russian and German circles, the use of aircraft in support of the existing land forces became the prime focus. Among the greater maritime powers "floating bases" – carriers – were also developed, this to be able to use air power in the battle for sea control. These ship-based aircraft had first a reconnaissance role, but became soon able to conduct attacks on naval surface forces. Aircraft in use against surface forces grew mature during the Second World War and proved effective. Great examples are the British decisive attack on the Italian fleet in Taranto of 1940, Pearl Harbour of late 1941 and generally throughout the war of the Pacific. As an answer to the evolving submarine fleet, especially that of Germany – land based aircraft were also put in the role of hunting and destroying submarines with great success.

By the end of the Second World War – the aircraft had made its permanent entry to the maritime theatre. Maritime Air Power became crucially important in reconnaissance and surveillance, as well as in anti-surface and submarine warfare. In addition it was clear and reckoned that the fight for Command of the Air, or at least self-defence was a prerequisite. Maritime Air Power had set

its position, but extensive theoretical as well as political arguing followed on organisation, development and fight for control of the air assets in an inter-service rivalry. This has since restricted the evolution of Maritime Air Power theory.

In my search for literature I have had great problems finding anything resembling a complete and thorough description of Maritime Air Power. Either is this such a clear cut that a definition is completely unnecessary, or the subject has in fact been neglected and just fallen between the services. Even the contemporary doctrines avoid defining this intersection between the naval and air forces.

There are great amounts of writings to be found on naval air power, but these are first of all descriptive on naval forces viewed as a service or an organisation. Secondly they are often purely schematic at a technological level and not discussed or funded in any broader military philosophy. B.C.Laite has written a book on maritime air operations.[1] This book makes a good description of the contemporary British Royal Air Force (RAF) and its maritime concepts. However, the definition of "maritime" made by Laite is evidently based purely on the British organisation of forces. "Maritime air operations may be defined as the activities of land-based, fixed wing aircraft in pursuit of a nations military policy, strategy and tactics at sea".[2] He separates maritime forces as land based, as opposite to the naval sea based forces. This is an often-expressed view, especially in British literature and circles. In my opinion, it is irrelevant where the aircraft are based – it must be about their purpose. This understanding is supported by NATO descriptions of maritime air operations:

> *In maritime air operations, land and sea based aircraft work in close co-operation with naval forces to ensure the most effective use of available air assets, with the aim of detecting, monitoring and containing enemy forward deployment, achieving defence in depth, and seizing and retaining the initiative.*[3]

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[1] B.Laite, *Maritime Air Operations* (London: Brassey's, 1991).
[2] B.Laite, *Maritime Air Operations*, p.4.
[3] NATO Allied Joint Doctrine, AJP-01, 2002, p.79.

There are also some useful articles by Till[4], Mason[5] and Hicks[6] there includes both land-based and naval air power in their perspectives on Maritime Air Power – but these are too short to give a great insight in its complexity.

Intentions and structure

The main problem is that there does not seem to be any comprehensive descriptions or theories for the broader understanding of Maritime Air Power.

This will be the focus of this dissertation – to try to bridge the gap of service-focused literature and discussions by making a comprehensive and common description of Maritime Air Power. This will necessarily at some point differ from established RAF and RN doctrines, as air and naval terminology is different in several aspects.

Of this aim of creating a comprehensive and cross-service understanding of Maritime Air Power, the dissertation will necessarily be broad and descriptive, rather than extensively argued.

The dissertation will have two sections – and methodologically the first section will be a theoretical literature study, followed by a historical case study.

- Section one: the *first* intention is to describe a comprehensive perspective on Maritime Air Power by creating a robust definition and describing all the involved elements in a conceptual framework.

To be able to achieve this, I will seek to find the commonalties and intersections of air and sea power concepts and theories – rather than dividing them. My belief is that Maritime Air Power must be derived from the greater thoughts and philosophies of use of maritime forces. Using this as a starting point, we see clearly that a description or definition must be based on the reason, purpose or most descriptive – the objective. It will be necessary to study the philosophies of sea

[4] G.Till, "Maritime Airpower in the Interwar Period: The Information Dimension" in *The Journal of Strategic Studies* (Vol.27, nr.2, June 2004).
[5] R.A.Mason, *Air Power, An overview of Roles* (London: Brassey's Defence Publishers, 1987), p.101-117.

power. In addition we must reckon that it is air power that is being applied, so the concepts of air power have to be examined as well. For air power in the maritime theatre, it is important to have in mind all the dimensions of air, surface and sub-surface.

Consequently, the *maritime objectives* and *the applied roles of air power* are what make Maritime Air Power distinct within the military theories in general. Evidently, it has elements of both air and sea warfare. In this sense, there will not be a true separate theory for Maritime Air Power, but rather a fusion of the existing theories of air and sea power.

Following this perspective – this research will break ground in creating a comprehensive and common description of applied air power in maritime warfare. The consequences of accepting this perspective will affect both communities. Readers, students and operational military of sea power will need to understand air power concepts, capabilities and limitations. At the same time the air power enthusiasts will have to accept the position of and understand the greater philosophies of sea power to be able to truly understand maritime air warfare.

- Section two: the *second* intention is to demonstrate and test the usefulness of the developed conceptual framework by conducting a historical case study.

I have chosen to examine British Maritime Air Power evolving through the Cold War era of Massive Retaliation to Flexible Response. My interest in studying British Maritime Air Power of this era has several reasons: This era is very interesting in terms of examining large and tactically balanced maritime forces, designed for all from small conventional war to large-scale nuclear war. This was the nature of Flexible Response. Most contemporary studies on air and sea power have been with an American perspective and focus, while a British case study enables to identify many of the hard choices and compromises that must be taken by medium (as well as smaller) military nations. This both in an economic sphere in relation to other demands of the states – as

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[6] In R.A.Mason ed, *War in the Third Dimension. Essays in contemporary air power* (London: Brassey's, 1986), p.169-186.

well as a significant inter-service rivalry on both resources as well as command of the maritime air assets. This is easily seen in the time period chosen, 1957-1967, when this period was radical for NATO and the Cold War play – as well as for British defence policies. The framework for the British policies included the NATO strategy of Massive Retaliation being adopted in 1956, the problems of this strategy and how it gradually was relieved by the strategy of Flexible Response from early 1960s – to finally being officially adopted in 1967. As for the British case of the same era, great national changes in military policies were pushed forward and described by the radical review of the mid 1950s and the Sandys Defence White Paper of 1957. Reliance on nuclear deterrence and downscaling of the armed forces were in focus. The RAF and Royal Navy (RN) experienced great inter-service rivalry over resources, organisation and new procurements, as well as changes in foreign policies and operational requirements. The NATO developments, revolutionary technological developments and the economic problems of Britain made this period a true turning point for the British Military.

Selected literature and limitations

The sources for the air and sea power discussion will be books and articles by classical writers who are viewed as primary sources in discussion on military philosophy. In addition I will use NATO and British contemporary doctrines, mainly as a reference for definitions. The focus of this dissertation is not to argue any problems of, conflicts between the RAF and RN doctrines or discuss the differences as of other air and naval doctrines.

In the chapter on air power I will discuss Douhet, Trenchard, Slessor, Brodie, Seversky, Warden, Armitage and Mason. Especially Douhet has a strong argument on the prerequisite of *Command of the Air* for all other operations to take place, as well as he argues the terminology *supremacy* and *superiority* in a splendid way. For a discussion on the classic and major objectives of sea power, I will rest on Mahan, Corbett, Castex, Brodie, Gorshkov, Grey and Till. For the main chapter describing *the elements of Maritime air Power*, I will discuss it in a contemporary

perspective and use historical examples for exemplifying the core capabilities and roles of Maritime Air Power.

For the historical case study on Maritime Air Power of Britain, primary sources as defence papers, doctrines and other notes from the National Archives in London will be used for identifying the greater maritime objectives.

There are reasonable amounts of writing to be found on British military policies of the Cold War era (e.g. by Grove[7]) in open literature. The tactical and technological aspects have on the contrary not been so thoroughly covered. Due to this fact, I will concentrated more effort in examining this in my research.

The RAF Hendon archives and the National Archives have provided valuable technical and tactical documents on the Maritime Air Power forces of the era. Great deals of highly classified material of the tactical and technical level, as well as to the political levels have recently been released. This is also a further reason why this era is so interesting to study in a historical perspective.

[7] E.J.Grove, *Vanguard to Trident* (Maryland: Naval Institute Press, 1987).

Section One: Theory of Maritime Air Power

Sea power

Defining Sea Power

Sea power is a concept hard to describe. Some of the reason may be that sea power has been a central part of warfare and international relations for centuries. Many have tried to define it, some have tended to avoid it (as Mahan), and some have tended to invent new terminology in hope that those would survive. These old never-ending circles have probably led to the various understanding of all the terminology of sea power.

Bernard Brodie says: "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".[8] I find this perception by Brodie as a very including, sound and useful description of sea power. C. Gray makes another reasonable description:

> *Sea power is not about the direct military effect of fighting ships, which is the realm of tactics; it is rather about the use of maritime lines of communication for the effective interconnection, organisation, and purposeful application of the war-making potential of many lands. Because of the unity of the oceans, the coalition superior at sea is able, uniquely, to wage a global war.*[9]

This is a common understanding of sea power, but still I will argue that it has a too specific focus on the lines of communications. Sea power is not about communication, but more broadly about all use of the sea. At least the sea basing in itself for force projection must be included as an important element of military sea power of today.

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[8] B.Brodie, *A Guide to Naval Strategy* (New York: Praeger, 1965), p.226.
[9] C.Gray and R.Barnett, *Seapower and Strategy* (London: Tri-service Press, 1989), p.22.

Russian theorists, as for instance Sergei G. Gorshkov, as well as the official doctrines include all maritime resources as oil, fishery, and communication lines etc. as true elements of sea power.[10] I agree with this total understanding of sea power, but for this research on war activities (the tensions of the Cold War and preparation for a direct war), I will merely look at maritime warfare. Maritime warfare is in this research to be understood as the militant part of sea power. NATO describes four applicable elements of military maritime operations: "Maritime operations include any actions performed by forces above and under the sea to gain or exploit Command of the Sea, sea control or sea denial and/or to project power from the sea". Further: "Maritime operations range from peacetime operations such as presence and surveillance and humanitarian operations, through operations in times of tension to combat operations".[11]

These elements may be placed under an umbrella of two main dimensions of sea power: first the aim for *a degree of sea control* and secondly *maritime force projection.*

- The struggle for a degree of sea control spans from the classical Command of the Sea – via the more contemporary and less all-encompassing degrees of sea control – and disputing the two latter by sea denial. These will be extensively discussed in next chapter.
- Force Projection from the sea is a also important element of naval warfare. Classically force projection has ranged from naval bombardment towards land-targets – to full-scale invasion in amphibious warfare. Today this would also include the global reach of both conventional and nuclear long-range smart munitions, as well as organic air power in roles as Air Interdiction, Close Air Support and Offensive Counter Air. By the working definition of Maritime Air Power based on the maritime objectives, force projection against naval assets and infrastructure are to be defined as Maritime Air Power. While force projection for

[10] S.G.Gorshkov, *The sea power of the State* (Maryland: Naval Institute Press, 1979), p.1-46.
[11] AJP-01, p.56.

influence on the land-war will not be a part of Maritime Air Power – though clearly still be defined as *naval air power.*

Command of the Sea

The terminology Command of the Sea (or Mastery) has been a central part of maritime military literature for more than a century. Captain Alfred Thayer Mahan is seen as a representative for this fight for Command of the Sea, and well known for his believe in the "decisive battle" as the main tactic for achieving Command. Corbett was in contrast to Mahan not so much occupied with the thought of Command 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 does appreciate it. He states: "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".[12]

Corbett argued that the use of the sea – what he called "communication" – was the object of naval warfare. After this, he argues that with safe communication as the sole purpose, the fundamental requirement is the means of exercising sea control for being able to use the sea.[13] Castex also notes the importance of communication: "...(when) communication is open, this permits a double action, economic and military, against the enemy.[14] Corbett and Castex noted the importance of sea control, even though it was not necessary the ultimate reason.

Today's focus on force projection makes these thoughts of Corbett even more correct. The achievement of a necessary degree of sea control is clearly essential for maritime warfare, and should refer to communication as well as safe basing and littoral access for force projection.

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[12] J.S.Corbett, *Some Principles of Maritime Strategy* (Annapolis: Naval Institute Press, 1988), p.118.
[13] J.S.Corbett, *Some Principles of Maritime Strategy*, p.112.
[14] R.Castex, *Strategic Theories* (Annapolis: Naval Institute Press, 1994), p.41.

Mahan and Corbett are probably viewed as the most significant classical writers on sea power, but also many contemporary theorists have discussed these concepts. Geoffrey Till argues that Command is relative and introduces the term "degree of Command".

> *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 extend to which it confers the capacity to use the sea for one's own purposes and prevent the enemy using it for his. Command of the Sea is about the use of the sea, not its possession.*[15]

I fully agree with Till in case of "Command of the Sea is about the use of the sea, not its possession", but I disagree on his use of the terminology "degrees of Command". With this he touches a subject that has been in the centre of many discussions on sea power (as well as air power). Also Brodie states that Command is something different than full control. Command 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 seriously that it will be decisive. Brodie clearly thinks of Command as a relative term, and he states that he "...prefers to speak only of control".[16]

I do not necessarily think there are any disagreements on the subject; this is more a classical philosophical hermeneutic question on the evolution of languages and how the meaning changes over time. As I read Till, Brodie and Castex they are in fact talking about degrees of control, as we understand it today according to contemporary definitions of control by NATO and daily military language in Western Europe.

Much discussion has been on Command and 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.*[17] This included naval raids on enemy communication and less capable ships, uses of mines, and amphibious operations. He constituted clearly an alternative to Mahan and those in favour of the decisive

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[15] G.Till, *Maritime Strategy and the Nuclear Age* (New York: St.Martin's Press, 1982), p.16.

battle. His thoughts are very important for the medium and smaller powers that face superior forces. In case of Maritime Air Power I find his thoughts of manoeuvre warfare very interesting for denial by use of air power with missiles and mines. Castex's theories also lead one in the arms of Gorshkov. Early Soviet strategies (prior to the Second World War) have been paralleled to the principles of *Jeune Ecole*[18], followed by a classical large-ship build-up under Stalin, and finally the new thoughts of Khrushchev and Gorshkov with an alternative navy. The period from the late 1950s till the early 1980s saw a build-up of an alternative – but impressing navy built around submarines and long-range air power, supported by the surface fleet. In this sense I will say that Gorshkov have much of the same ideas as Castex. Gorshkov built a navy for manoeuvre and sea denial.

As a conclusion, I find it most suitable to understand Command of the Sea in a relative sense in line of Brodie, Castex and Till. Then, Command is not about possession, but about achieving a situation where one safely and effectively can use the sea for all own purposes, including both military and commercial. As Brodie says: "Command has never meant control which was either complete in degree or unbounded in maritime space".[19]

Command can following not be a concept or aim of any naval forces – but it is a relative term one may use of a supreme sea power that is unchallenged on the general use of the sea. For instance may the US Navy today perhaps say that it has Command of the Sea by the fact that it uninterrupted can use the communicational lines, hold safe sea basing for force projection – and at the same deny most opposing forces to use the sea. At the same time it is important to note that they in many cases hardly will achieve full control of the littorals.

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[16] B.Brodie, *A Guide to Naval Strategy* (Princeton: Princeton University Press, 1944), p.91.
[17] R.Castex, *Strategic Theories*, p.184-202.
[18] The terminology "Jeune Ecole" was introduced in 1884 by Admiral Hyacinthe-Laurent-Theophile. It advocated torpedo boats and fast commerce raiders (R.Castex, *Strategic Theories, p.xiv*).
[19] B.Brodie, *A Guide to Naval Strategy* (1944), p.91.

The *practical maritime objective* of maritime warfare – and thereby Maritime Air Power – must be the struggle for achieving the necessary degrees of sea control. This is a pre-requisite for being able to exploit the sea for communication as well as basing for force projection – which are the superior objectives. If one is not able to achieve this, the practical maritime objective will be sea denial – this to dispute the control of the enemy, and to deny him to use the sea.

Sea Control

In contrast to Command of the Sea, which I have argued 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 the dimensions *space* and *time* – and must be safeguarded at all times.

The British maritime doctrine states: "Sea control is defined as the condition in which one has freedom of action to use the sea for one's own purposes in specified areas and for specified periods of time and, where necessary, to deny or limit its use to the enemy".[20]

The doctrine further states: "There is likely to be requirement for sea control across the spectrum of conflict".

The NATO Allied Joint Doctrine describes sea control as:

> *Sea control allows the use of the sea in specified areas and for specified periods of time. The early achievement and retention of a level of sea control is a likely requirement across the whole range of military operations, and sea control will be a component of an allied joint campaign or operation. The level of sea control required will be a balance between the desired freedom of action and the degree of acceptable risk. Sea control comprises control of the surface and sub-surface environments and the airspace above the area in which control is required.*[21]

Following, 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 own use of the sea.

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[20] British Maritime Doctrine, *BR 1806* (1995), p.34.
[21] AJP-01, p.56.

- 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.

I find it useful to divide sea control in *Area Sea Control* and *Local Sea Control*, based on the physical dimension as well as the objectives involved.

Sea control has an obvious dimension as control of a physical area and we will then talk of Area Sea Control – and by that mean sea control of a defined larger area. This category of sea control will include blockade and barrier, as well as embargo and interdict 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 situation is not unlikely to be achieved by any major power over a weaker opponent. On the other hand, in a war between powers of some equal strength, Area Sea Control can be hard to achieve. Today, with the introduction of easily 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 within this next generation of military technology – especially in case of control of the littorals. 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 asymmetrical challenges to the larger ones, and may eye each other in distinctly traditional sea control terms."[22] It is in most cases more useful and maybe necessary to modify Mahan's concept of Command of the Sea in line of Corbett, who argues that the realistic aim is a limited control of the seas for one owns particular and immediate purpose.

[22] G.Till in P.O'Brien ed, *Technology and Naval Combat in the Twentieth Century and Beyond* (London and Portland: Frank Cass, 2001), p.227.

In case of Local Sea Control – the dimension of control can be more local in protection of offshore installations, ports and inlets, as well as protection of Sea Lines of Communication (SLOC) by convoying and escorts.

This concept of control, which I have labelled Local Sea Control, is less extensive than Area Sea Control in three main aspects. First, local sea control *does not fully deny the enemy of using the sea* for his own purposes – it is about safeguarding own defined forces. Secondly, it is normally less demanding on own resources and forces. As the third aspect, the concept of Local Sea Control is largely to be understood as *defensive* use of maritime forces, but may include offensive elements.

Sea Denial

An objective of sea denial or at least disputing the Command or control of a greater maritime force has classically been seen as prerequisite for land-powers at war or conflict with a maritime nation. If one is not able to secure the necessary degree of control, or find the cost too expensive, or unnecessary for the greater strategies – one must resign oneself to a strategy of sea denial. Sea denial may be achieved by various means. For instance, the classical naval fleet may be used in a "fleet in being – strategy" that seeks merely to deny control to the enemy.[23]

NATO describes sea denial:

> *Sea denial is exercised when one party denies another the ability to control a maritime area without being able to control that area himself. Sea denial is not a concept distinct from sea control, as denial of an adversary's freedom of action is an aspect of sea control. However, the concept is applicable only when full sea control is not exercised by choice or by necessity. At the operational level, a zone of sea denial may be used as part of the outer defence of a force or area, or a way of containing opposition forces. At the strategic level, sea denial can be used in warfare, by sustained attack on an adversary's shipping to prevent reinforcement and to sap national morale and the ability to wage war.*[24]

[23] G.Till, *Maritime Strategy and the Nuclear Age*, p.133.
[24] AJP-01, p.56-57.

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

Today the nuclear submarines and aviation with missiles are the most potent systems for sea denial of the oceans. Surface forces may also be part of the forces used in a strategy of denial, but in this case we are soon in the hazy areas to where one in reality is fighting for a degree of control. For the littorals: land based air power, missile systems, conventional submarines and mining, and to a limited degree surface forces are asymmetric and additional capabilities to those oceanic forces. In case of strategies of sea denial in asymmetric warfare, the concept is to pose such a great threat that it will be unacceptable for the opponent to carry on.

Air Power

Defining Air Power

Many attempts have been made to create a good definition of *air power*. All from the all-encompassing to the extremely narrow definitions have been presented. The all-encompassing definitions tries to include all possible understanding of air power and warfare - but are then very little useful in any practical work or research. The narrow definitions are often coloured by the person's background, operational as academically. The very narrow definitions will be easy to defend in research, but probably of little use for the operational commander in war.

One may say that it is hardly possible and even needless to work towards definitions in general. Personally I think it is useful. Even if it is almost impossible to make a perfect of such, it is an important philosophical task working towards definitions. Further, having a written and common base, you have a foundation for future discussion, personal and organisational learning. Definitions sets forth in doctrines are also important for force structuring. This may well be against the stated intentions of doctrines as "guidelines", but the reality is that they by their position will affect future choices – especially in time of economical strains on military expenditure. Historical examples may be the way RAF made doctrine – and built an airforce for "strategical bombing" in the Inter-war period. Today we make doctrines and build air forces for (primarily) expeditionary warfare and crisis management... Another historical example of the more tactical-technical level was how RAF failed to make any doctrine for anti-shipping prior to the Second World War.

Contemporary British definition of Air Power is: "The ability to project military force in air or space by or from a platfrom or missile operating above the surface of the earth. Air platforms are defined as any aircraft, helicopter or unmanned air vehicle."[25]

[25] AP 3000, p.1.2.1.

British Air Marshall Armitage and Vice Marshall Mason argues several perspectives and definitions, and consequently made this definition in their book "Air power in the Nuclear Age": "The ability to project military force through a platform in the third dimension above the surface of the earth".[26]

The variety of Air Power definitions has been argued extensively. One frequent discussion on definition of air power goes on the use of missiles, both sea and land based, and their place in concepts of air power and air defence systems. The most extreme air power enthusiasts will say that *all* use of missiles are to be understood as air power. I think it is wrong to make this assumption – especially in case of surface-surface (ballistic) missiles. For surface-air missile systems it is a simpler case. Still, there are some grey-zones. For a surface-air missile (or any weapon) to be labelled air power, there should be some link to the mission objective, where the aim must be to achieve some degree of air control or denial. To be able to do this, a missile system must have some range and probably be co-ordinated or even integrated. In my view, short range missiles that are solely used to defend a local site, land or maritime, and which are not co-ordinated to create a system for area defence will not be described as air power – but only be understood as "local air defence systems" or "point defence".

One critic to Armitage and Mason's definition is that they include all space-related activity. The RAF doctrine avoids this by defining only aircraft, helicopters and UAVs as air platforms. It does not include space platforms. I do not find it a sound definition to include space (even though that is the normal position). We should rather understand space as a theatre of its own – just the way air power fought for its existence less than a hundred years ago. Space technology and warfare will constantly support all the other services and will even be able to operate solely on its own if needed in near future. In opposition to terrestrial air assets that operate in the earth's

[26] M.J Armitage and R.A Mason, *Air power in the Nuclear Age, 1945-82* (London: Macmillian, 1983), p.2.

atmosphere, space is characterised by the laws of orbital motion, high-energy particles and fluctuating magnetic fields and temperatures.

Throughout history, also different perspectives on how air power is best exercised have been debated. After aviation had become truly popular after some astonishing navigational flights and had been introduced in a variety of roles throughout the great War – a great deal of prophetical writing were put forward in the Inter-war period. Many different perspectives were fronted, but the public works of Giulio Douhet, as well as the publications of Viscount Trenchard and Mitchell and their organisations got the greatest attention. Many reckon these men as the first "classical theorists" on Air Power.

Douhet was a great believer in strategic air power – the use of air power to achieve a decisive result from bombing alone. The British forces, led by Trenchard, also proposed this great belief in the bomber. After the Second World War, also John Slessor followed up on this perspective till the Polaris had revealed the RAF V-bombers of their strategic dominance late in the 1960s. Slessor stated still in 1954 that there was no reason to be depressed by the fact that Lord Baldwin's dictum "the bomber will always get through" was still true.[27] The bomber still was viewed as the only way of safeguarding the peace. John Warden, as a contemporary addition to these classical theorists, may well be mentioned as a true believer in strategic air power.

> I will say that this focus on strategic air power has got a disproportional attention in air power circles. It can best be described as a "*strategic bombing complex*".[28]

The reasons for this may be complex, but at least some of the rationale is probably to be found with a study of the strong frontlines and inhuman great sufferings from these static lines of the Great War. In addition, the fight for independent air services "needed" theories on how air power

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[27] J.Slessor, *Strategy for the West* (London: Cassel & Co Ltd, 1954), p.20.
[28] As a derivate of Slessors title to an article on the RN: "The Capital ship Complex", AIR 75/80, (declassified SECRET).

more or less independently could decide the outcome. Air power could not be used as a "support" to the Army or Navy.

Two general aspects on this group of air theorists: First, I do not disregard strategic air power. There may well be wars where this will be possible. Still, it must be reckoned that most conflicts and wars will see other sides of air power primarily. Secondly, these writers presented a clear consensus on the importance of Command of the Air as a *prerequisite* for other forces. This latter I support fully. The fact that this is significant, often essential, for all other air, sea and land forces to operate effectively must be reckoned.

Alexander Seversky, Trenchard and Slessor also make up another defined group of theorists who wrote much on the superiority of air power over the other services, especially that of the navy. The title of a note by Trenchard "The change over from sea power to air power" is very descriptive. It must be held to the defence of these writers that they wrote their books and articles in a time where the air forces fought for independence or for being reckoned as an equal service.

Some more comprehensive and objective descriptions of air power, at least in the perspective Maritime Air Power, are to be found with e.g. G. Till, R.A. Mason, B. Brodie and later writings of Liddell Hart. These theorists have enabled to show the complexity and width of the air power roles.

The fight for Air Control

In this short chapter I argue the importance of air control, still – it is important to keep in mind that air control is seldom a aim *per se*. In the Inter-war years, Britain focused their air forces on bombers as the offensive weapon, and a limited force of air-air combat aircraft for protection of the British Isles. During the Cold War, the intercept role further got great attention. This due to the great Soviet fleet of bombers and strike aircraft.

In Air Force circles, and not just in Britain, Air Power was focused on the strategic bomber and the fighter aircraft. This has (with right) been criticised after the end of the Cold War. Contemporary we actually see that air power to a greater extend are becoming balanced for all kind of roles in the land theatre primarily, but also in the maritime theatre.

The fight for air control, what we broadly may label Air Control Warfare, is not an aim *per se* – but is very often a prerequisite for other forces.

Command of the Air

Douhet argued that the first objective always had to be to conquer the Command of the Air. Secondly he argued for the massive crushing of material and moral resistance of the enemy. Because of this second objective of his, as well as his total rejection of auxiliary air power, he has tended to be disregarded today. I will not go into the discussions on Douhet's second objective or general theories, but stay with his first objective – Command of the Air, which he stated as essential.

By Command of the Air he meant: "...that state of affairs in which we find ourselves able to fly in the face of the enemy who is unable to do likewise". At the same time he stated:

"The Command of the Air provides whoever possesses it with the advantages of protecting all his own land and sea territory from enemy aerial offensives and at the same time of subjecting the enemy's territory to his own offensives".[29]

Both air and sea power are fluctuating in nature. It is hard to "hold ground". This is a very important prerequisite for understanding theories applying to these two dimensions. One may argue that the term Command will always have to be relative, if not it loses its meaning in the sense that no one "can hold the air" permanently. On the other hand one may assume it achievable if one totally destroy the air capabilities of the enemy. I cannot see that one may

[29] G.Douhet, *The Command of the Air* (Washington D.C: Office of the Air Force History, 1983), p.95-96.

achieve Command without this – and if not able to totally destroy the air capabilities of the enemy – one must resign to an aim of air control of an area defined by space and time.

Douhet strongly opposes to talk about *any degree of* Command of the Air, or relative Command of the Air. He argues that Command of the Air restricted to a particular zone of the sky is to confuse preponderance with Command.[30] Still, the aim of controlling the air over a defined area is very much a reality in employing air power today. Thereby it must be possible to talk of something less absolute than Command of the Air – not a relative or degrees of Command, but a degree of air control. This implies a working control physically limited to the area of interest. This is more reasonable and normally "cost-effective" in contrast to an aim of Command.

In Maritime Air Power, air control is often a pre-requisite for other forces. Having a maritime objective of sea control actually include air control as noted in previous chapters. As with sea control, air control must comprise the two fundamental dimensions of *denial* and *safeguarding*.

If neither of the opponents holds any degree of air control of the specified area nor Command in relation to his opponent – we end up with a situation of air neutrality. This does not refer to international law; it describes a situation in wartime where none of the sides hold any degree of control of the air. Both sides are consequently tactically free to operate their air forces – if they have any offensive capabilities.

Degrees of Air Control

Contemporary doctrine, the British AP 3000 included, measures air control in three levels: "Favourable Air Situation", "Air Superiority" and "Air Supremacy".[31] The highest level of control in the air is labelled supremacy. This is defined by the British doctrine as that level of control where the opposing air force is incapable of effective interference. Air superiority is less

[30] G.Douhet, *The Command of the Air*, p.98.
[31] AP 3000, p.2.5.2.

all encompassing – and is defined as that degree where own air, sea and land forces at a given time and place may operate without prohibitive interference by the enemy.

If one is not able to achieve a relative superiority or supremacy in relation to the enemy, there is still possible to achieve a favourable air situation. This is defined as that level of control where the enemy air forces is insufficient to prejudice the success of friendly land, sea and air operations.

Air Supremacy and Air Superiority – and the naval surface forces

Much conflict between navies and air forces, as well as between naval and air power theorists have been on this issue. From the naval side, the significance of air superiority has been underrated – while perhaps the air power advocates have tended to exaggerate its importance.

Trenchard wrote some classified notes[32] and pamphlets[33] on the rise of air power and air power versus classic naval power. He was basically listing arguments on the superiority of air power over the classical naval surface force. He argued that aircraft had become the prime weapon of the navies and further that land based air power was far superior to the carrier based. The carrier, as well as all other expensive and prestige vessels, tied up far to much air power resources for its own defence. Air power should be used directly against surface forces, merchant communication and the support facilities of the enemy navy. As he clearly was premature in much of his argument on how air forces should replace all naval forces, I will support some of his conclusions. "...no fleet, however powerful, can operate effectively within reach of an undefeated and strong air force".[34] This is also stated by the contemporary air theorist Warden: "No defence has sustained itself against an enemy who had air superiority",[35] as well as the British air power doctrine: "A degree of control of the air is of crucial importance, not only to air

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[32] AIR 23/1360, "The change over from sea power to air power", note by Viscount Trenchard (declassified SECRET).
[33] AIR 20/5567, Pamphlets by Marshal of R.A.F. Viscount Trenchard: "*The Principles of Air Power in War*", "*Air Power and National Security*" and "*The Effect of the Rise of Air Power on War*" (declassified SECRET).
[34] AIR 23/1360.

operations but also to virtually all types of surface and sub-surface operations". But at the same time they notice that: "Even in a generally hostile air situation, it is usually possible to achieve some degree of air control for friendly operations".[36]

This last note I find very important. Over the last two decades, the air defence systems of the larger anti-aircraft ships have become significant. As for instance the American AEGIS ships and the Russian Kirov-class, both introducing a potent denial system with standoff ranges of more than a hundred nautical miles for all aircraft. Still, it must be noted that even the air defence systems of these modern larger naval ships have become very effective, it is also clear that they all have a crucial and defined limit to sustain well co-ordinated attacks. Concepts of "missile overload" on these systems must be used.

To summarize; these capabilities of the Air Defence destroyers and frigates with their sensor and weapon systems for AAW are truly a part of the total Maritime Air Power concept. And with this acknowledgement I will in contrast to most air power theorists say that air superiority is not a necessity for naval operations – the navies only have to *deny* the enemy to use his air power unlimited. *Air supremacy* or the less total *air superiority* will not be a necessity for maritime operations, but highly preferable. If one is not able to achieve any positive degree of air control, one must at least be able to deny the enemy unlimited use of the air for his purposes.

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[35] J.Warden, *The Air Campaign*, 1989, p.10.
[36] British Air Power Doctrine, *AP 3000* (1999), p.2.5.1.

Comments to the dimension of Space

As for space and military capabilities, this dimension is still commonly understood as "neutral", where no states or forces are able to obstruct others from using it. In near future this situation will most likely change – a fight for *a degree of space control* will become crucial and important in military warfare. The perspective of free access will probably be replaced by the abilities of denial, followed by the evolution of space control warfare – and the end to a perspective of space assets as a merely supporting forces.

The first step is detection, tracking and classification. These roles are already fully achieved by ground based radar systems with imaging applications. The next step, blinding or destruction of other satellites by use of electromagnetic pulses, microwave pulses and lasers are constantly being explored. One important factor is that systems like directed-energy weapons for space denial do not have to be space-based. It is expected that low-power laser systems today are able to blind low orbit satellites, but more powerful lasers with longer range and precision to take out all types of satellites are not far from coming operational. Surface based systems are becoming a reality even with countries not able to employ own space systems. Common perception in military communities is that capacities, if still rough, are present to deny enemies free use of space. Examples are the Mig-31D system with Vympel anti-satellite (ASAT) missiles. Space is today mainly used for intelligence and surveillance, navigational and communication tasks, but this will probably change to include all aspects of warfare in near future.

Space power is still being included in air power by most, not at least for production and technical facilities. It is often under the label Aerospace. Still, space power is clearly distinct from air power, and I do think we will see it as an independent service in the future. The environmental difference has actually far more differences than commonalties, and consequently the platforms will probably never be of aerospace nature.

As Deblois of the US School of Advanced Air Power Studies states:

> *A space vehicle will out-perform an aerospace vehicle in space: A typical aerospace vehicle will carry the baggage of air capability, such as wings, into space. An air vehicle will out-perform an aerospace vehicle in the air: A typical aerospace vehicle will carry the baggage of space capability, such as radiation shielding, in the air.*[37]

He further states: "...missions are either in the air or in space, and only a few missions are performed at the boundary". Same as for sea and land forces, it is possible to design a vessel to operate in both dimensions – but it will always have too many compromises. We must recognise that different environments require different forces.

For now, space is still viewed as an integrated part of air power. The use of this physical dimension is today about intelligence, surveillance and reconnaissance – as well as communication and navigational support. The parts of aerospace or space power included in this dissertation will be under the chapter on Information Exploitation.

[37] B.Deblois, *Beyond the Paths of Heaven* (Hawaii, US: University Press of the Pacific, 2002), p.x-xi.

Maritime Air Power

As lined out in the introduction, a complete and agreed upon, or *at least often used* definition of Maritime Air Power is not present in either academic or doctrinal writing. The British AP 3000 for instance, avoids defining Maritime Air Power, and jump straight into the roles of ASW and ASuW. Is there not more to Maritime Air Power than ASW and ASuW? The Maritime doctrine does neither give a definition or a thoroughly description of Maritime Air Power – but at least the book in its introduction states 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."[38] Still, with this "good start", they later also talk of maritime air operations as something delivered from the air force.

There is clearly little consistence on use of terminology on this field. Due to the poor descriptions of the comprehensiveness of the field of Maritime Air Power (especially by the air power doctrine), I will discuss the issue both from a naval and air perspective for presenting an possible cross-service conceptual framework.

Maritime Air Power might be seen to have several meanings. One often used, which I will not be using, is the naval organic aircraft category often expressed by the larger navies, which by the naval heritage and physical integration and interaction obviously is an important part of maritime warfare. *Organic aircraft* is a common and international naval term meaning *sea-based* aircraft, including all from combat aircraft from carriers to light helicopters operating from decks of ordinary surface ships. I will argue that this most correctly and descriptive should be labelled *naval air power*. The old British Naval War Manual from 1958/61 also supports this: "The adjective 'naval' is reserved for matters which are exclusive concern of the RN (e.g. Naval

[38] British Maritime doctrine, BR 1806, 1999, p.3.

Discipline, Naval Establishment)".[39] Naval air power would consequently involve all air-assets and operations that are owned, administrated, executed and commanded by the navy. On the other hand, a great deal of the contemporary carrier based naval air power, specifically naval force projection by use of air power, is to be understood as *solely air power* in most cases, and all theories and principles for air power in general will 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 e.g. Afghanistan uses the same concepts as its air force counterparts.

Another meaning, mainly expressed by contemporary British literature, stating that Maritime Air Power is land based air power operating at sea. The Air Power doctrine is in essence only speaking of anti-submarine warfare (ASW) and anti-surface warfare (ASuW), while Laite at least includes some more roles of air power at sea. This is a narrow understanding, and clearly in conflict with normal understanding of the term "maritime". This is probably a result of the British organisation of forces.

A third meaning of Maritime Air Power, which I will use, is about all aspect of air power applied in the maritime theatre. This is very much what one may read out of the supreme NATO joint doctrine[40] where it states: "In maritime air operations, land and sea based aircraft...". This is a view shared by many military thinkers, e.g. G.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)".[41]

This broader understanding is the focus of this research. Whether the air asset is organic or land-based, administrated 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.

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[39] Naval War Manual, *BR 1806* (1957/1961) (declassified RESTRICTED), p.3.
[40] AJP-01 (2002), p.79.

Following, the broader understanding is clear, but there is lack of a concise definition of Maritime Air Power. From the above perspective – a cross-service, including and descriptive definition of Maritime Air Power could 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 there exists a theory of Maritime Air Power, this is a derivation and fusion of maritime and air warfare theories. This requires the reader, lecturer and the operators to understand the nature of both air and maritime warfare to be able to understand Maritime Air Power.

By using this perspective and this definition – I think we will enable to describe the comprehensiveness of the field, and be able to point out the maritime objectives and the variety of roles air power play in the maritime theatre.

[41] G.Till, "Maritime Airpower in the Interwar Period: The Information Dimension" in The Journal of Strategic Studies (Vol.27, nr.2, June 2004), p.322.

The maritime objectives

The *maritime objectives* are about the specific maritime aims of the military strategic level. The maritime objectives will in this research on Maritime Air Power be defined as the greater maritime concepts of sea control (area and local sea control) and sea denial, of which were discussed above in the chapter on sea power. In addition force projection is an important naval objective. This objective will be limited to amphibious warfare and tactical strikes against naval forces and support facilities in case of Maritime Air Power. For land-attack exceeding the imminent maritime facilities as docks and naval infrastructure, the theories or concepts are already well described by existing air power literature. This is a natural crossing-line between Maritime Air Power and air power theories in general.

These principal sea power objectives have been essential since the beginning of maritime war philosophy and are still with us. They are prerequisites for and include all the concepts of more descriptive nature (littoral access and force protection, barrier and blockade, embargo and containment, convoying and escort, fleet-in-being etc). These concepts, which are variants of the principal objectives, evolve to describe trends in the military and political state or focus of the time, but do often disappear or give place to new concepts in time.

The core capabilities and roles of Maritime Air Power

I will argue that there are a variety of roles air power plays in the maritime environment. The magnitude may be lost if we not first define the principal or core capabilities air power should play[42]. As Maritime Air Power in general is somewhat poorly described and agreed upon, there are not defined a level or terminology, which the naval and air force literature have agreed upon. I find the term "core capability" used by the air force community descriptive – and will use a derivate of this to describe a list relevant to Maritime Air Power.

[42] Air force terminology does not cover a maritime air level above the roles of ASW and ASuW. AP 3000 have a good description of the general air power capabilitites, and this is a derivation from this terminology.

The core capabilities must be descriptive for the obvious environmental warfare areas or disciplines used by the naval communities – and these are very much permanent. For instance: there will always exist maritime *Surface, Subsurface* and *Air Control Warfare*. In addition; *Information Exploitation* is recognized as crucially important and is reckoned as a core capability of air power. Last, but not least - *Force Projection*[43] for naval and air forces to inflict on the land situation are one of the primary objectives of sea power. Force Projection cannot be disregarded as a core capability of Maritime Air Power.

After defining this set of core capabilities, it will be possible to give a methodically description of the "roles of maritime air power". A role describes the specific purpose or reason for a unit in military operations. For instance, within the core capability of Subsurface Warfare, there will be the applied roles of anti-submarine warfare and mine warfare. New roles, subordinate to the core capabilities, may well arise or disappear with different threats and technology, as well as they will vary with the requirements of the specific operations. In addition, there might well be other forces in supportive roles, e.g. EW (jamming) support within the role of Anti-Surface Warfare.

This separation of *core capabilities*, *roles* and even *supporting roles,* as separate levels are important for not loosing sight of the span of maritime roles. To often are maritime air operations simply divided into ASW and ASuW, which are only two out of all the important roles of Maritime Air Power. This is the pit-fall if one does not first describe a supreme level of core capabilities or warfare areas. This is a viewable problem of the contemporary British Air doctrine as mentioned, were it fail to mention many of the roles, e.g. sea mining and counter mining by jumping straight into the specific role of ASW.

[43] The term "power projection" is somethimes used. The difference is essential, and must be noted. The difference is that "power" refers to the greater strategical outcome. The term "force" is more useful for the description of applied roles of air power. The British Maritime doctrine labeles the total concept as "maritime power projection".

The span and complexity of core capabilities and roles of Maritime Air Power may be visualized in the following model:

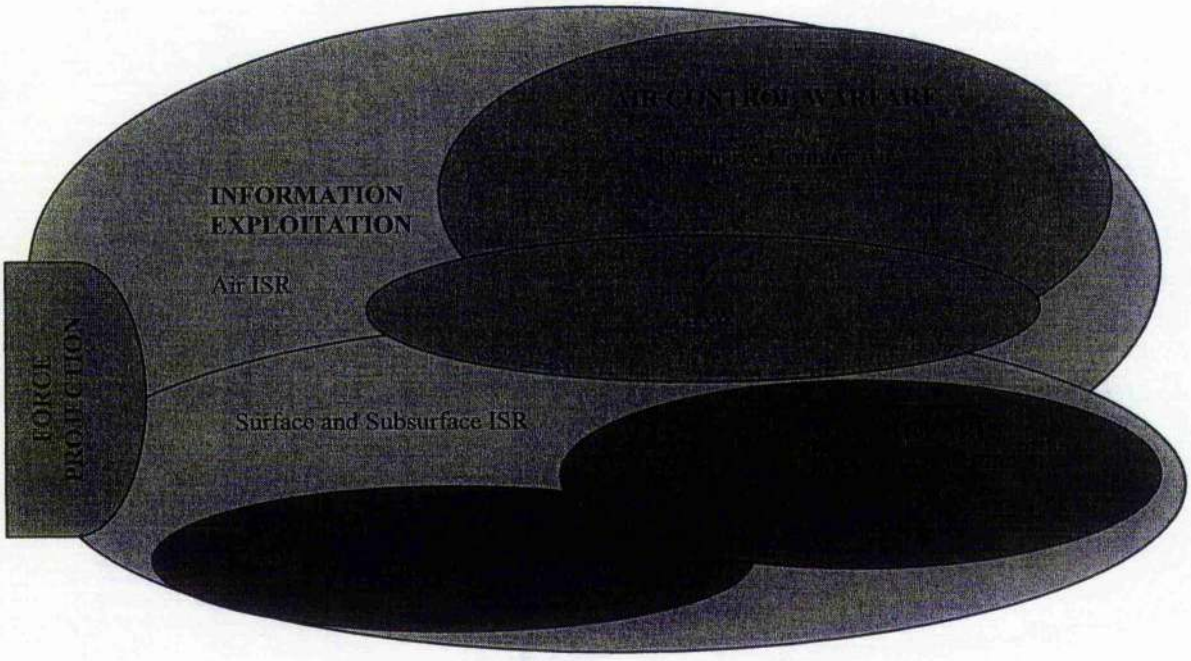

Figure 1: The core capabilities and roles of Maritime Air Power (Dyndal, 2004).

The first core capability: Information Exploitation

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

The meaning of *intelligence* in military sense is about a; "... product resulting from the processing concerning foreign nations, hostile or potentially hostile forces or elements, or areas

of actual or potential operations. The term is also applied to the activity which results in the product and to the organisations engaged in such activity".[44]

Intelligence operations and goals range from the lower tactical levels to the top political level. As for maritime air forces, they are constantly involved in intelligence operations by their collection of data. Still, some aircraft and crew are more specialised for this role than others. The field of 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 strategical decision-levels are able to take the correct actions. These will in most cases stop conflicts before the parties are going to unnecessary military confrontation.

Surveillance is the *systematic observation* of all the dimensions: space, air, land and surface and subsurface. Maritime theatre surveillance includes the surveillance of all activity that would inflict on the maritime theatre. Surveillance is conducted and compared over a period of time.

The core capability of Information Exploration also includes the surveillance of the air dimension. For air surveillance and early warning, both land based and surface ships – as well as airborne systems have been important. Contemporary Airborne Early Warning (AEW) is described as "Air surveillance and control provided by airborne early warning aircraft equipped with search and height finding radar and communication equipment for controlling weapons systems".[45] We see that the AEW systems include command and control capabilities and responsibility. Aircraft were used in this role from the later part of the Second World War (e.g. radar-equipped Avengers of US Navy), but these early aircraft were not capable of great detection ranges, neither to have any command or control role. Even the first large AEW aircraft being developed in the 1950s, were not able to hold any true command and control over own aircraft in combat, but did only give basic information for interceptor aircraft. The roles of both

[44] AAP-6.
[45] NATO AAP 6, (Allied Administrative Publication), 2002.

the smaller organic AEW, as well as for the first generation of larger land-based AEW were mainly *early warning* to the naval surface forces (especially against low level attack aircraft under the horizon of the surface radars), or early warning for detecting the strategic nuclear bomber fleets of the 1950s onward. The Soviet "Moss" Tu-126s AEW was designed for this plain early warning role. The Soviet Union did not get any offensive capability (including directing fighters in combat) with their AEW systems till the early 1980s. By then the first Soviet AWACS[46], the A-50 "Mainstay", was introduced with a true down-looking radar. The US had developed this technology some 10 years earlier, while the British had great problems getting a modern radar with true command and control functionality to work with their Nimrod AEW or AWACS project of the 1970s and early 1980s.

The third role within Information Exploitation is *Reconnaissance* and it 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 to the naval surface forces. In maritime warfare the reconnaissance role gives invaluable inputs to the Recognised Maritime Picture (RMP), which includes subsurface, surface as well as the air picture. The full definition of RMP is "the fullest achievable agreed level of identification and tracking of all air, surface and subsurface contacts in the area of interest".[47]

Damage Assessment, as a component of reconnaissance, is also an important task of Maritime Air Power. The assessments of the attacks have always been important – but are today a true focus of the operation both for immediate follow-up attacks, and not at least for political reasons.

[46] AWACS: Airborne Warning and Control System.
[47] BR 1806 (1995) p.234.

Space-based systems for electronic surveillance, as well as optical and radar reconnaissance are today essential for the greater nations. This enables information superiority. As for the quality of the photographic reconnaissance satellites, orbiting at altitudes of between 200 and 500 kilometres, they are equipped with wide-angle cameras for area survey work, whilst small field of view cameras are designed for detailed inspection of features of interest. These small field of view cameras have been estimated to obtain resolutions in the order of 10-15 cm on the ground under favourable conditions.[48] All electro-optical systems relying on visible light have the limitations of penetrating fog, haze, smoke, cloud or rain. To counter this, two other main technologies have been deployed, thermal imaging sensors (better penetration but at the expense of much lower resolution in the order of 10-15 metres) and Synthetic Aperture Radar. The latter is a true all-weather capacity, and is becoming truly "high-resolution".

Today, the ISR capabilities of Maritime Air Power have dramatically changed the tactics and concepts of maritime warfare. Normally, no naval surface forces are able to operate hidden – not even the "stealthy" vessels. The naval surface forces require highly capable self-defence systems for air denial purposes or full area air control to be able to operate effectively at war. Modern active as well as passive maritime air and satellite surveillance systems have become truly global in reach. Asymmetric surface forces, small civilian vessels loaded with explosives or armed with small but sophisticated missiles are the evolving surface threats to the greater military forces.

Another important platform for ISR is the evolving and capable UAV. The long-loitering UAVs are become a true supplement or even a replacement for both aircraft based systems as well as high-cost (and vulnerable) space systems.

Finally it is important to realise that all the elements of Information Exploitation are integrated in or make the foundation of the three following core war-fighting capabilities of Surface, Subsurface and Air Control Warfare.

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[48] http://www.anu.edu.au/english/jems/lb/majorwriting/Thesis/chapter3.html , April 2004.

The second core capability: Surface Warfare

The second core maritime air capability is about Surface Warfare. Surface warfare is about controlling the enemy or denying the enemy to use the sea, and if necessary to destroy his military and other sea forces. Surface warfare for maritime air forces may be divided into *Anti Surface Warfare (ASuW)* and *Maritime Interdict.*

To start with the latter; Maritime Interdict operations (e.g. against smuggling, piracy and drug traffic) have to a great extend become the "daily" role of maritime air forces in peace, crisis and limited war operations, especially in case of organic helicopters and maritime patrol aircraft (MPA). There are many contemporary concepts described for these types of operations. The following two are often used: Naval Control of Shipping (NCS) and Maritime Indict Operation (MIO). The purpose of NCS is to control merchant shipping of allied nations in periods of crisis and conflict, including Crisis Response Shipping and neutral shipping under charter to allied nations, in order to enhance their safety. MIO encompass seaborne enforcement measures to interdict the movement of certain types of designated items into or out of a nation or specific area. These measures may include enforcing economic sanctions via an embargo of a particular country's international trade. Embargoes have several distinct advantages over other compelling measures involving hostile actions and are conducted to resolve disputes through measures short of armed conflict, while allowing limited and controlled force to be used, if necessary. If tensions rise, the affected nation's war fighting ability can be diminished by an effective embargo on military supplies.

For the classical war fighting roles within Surface Warfare, they are all embraced by the role of ASuW. The common contemporary understating of ASuW is that this includes all actions against an adversary's surface forces or merchant ships to achieve sea control or sea denial and to disrupt his sea lines of communication. ASuW operations should ensure the timely detection and engagement of an adversary's surface forces so as to deny their effective employment. Once a threatening force is detected, the composition and disposition must be ascertained before

counter-action or attack can effectively be executed. In littoral waters fast attack boats, which are operated by many nations, may pose a threat to own maritime operations. Due to political as well as navigational constraints, larger combatants may not be suited to operate freely in these waters. Fast patrol boats, operating together with larger combatants and helicopters, may at the same time offer the best solution to counter this threat.[49] Air power may (and should) in these operations both be tasked for building a recognised maritime picture, as well as to deliver lethal and non-lethal application of power. The role of ASuW embraces all from ISR of Information Exploitation and targeting, to the direct application of force.

Lethal ASuW has often descriptively been labelled "naval air strike" or just "strike". It involves aircraft delivering bombs or missiles against surface targets at sea. This was an early role of aircraft in maritime operations, and well developed through the two World Wars (but then the initial weapons were torpedoes and bombs, and later short-range rockets).[50]

The war of the Pacific gives several good examples of aircraft fighting the surface war. The 1942 Battle of the Coral Sea in the Pacific is reckoned as the first great naval engagement fought without opposing ships.[51] The US carrier force stopped a Japanese attempt to land at Port Moresby, New Guinea. Task Force 17 with the carrier Yorktown air-bombed Japanese transports landing troops and damaged several and sank one destroyer on 04 May 1942. Task Force 11 then joined Task Force 17 with their carrier Lexington. They placed an attack group of naval vessels to protect the islands from the approaching Japanese. The carriers then went north and seeked out and sank the light carrier Shoho on 07 May, while those Japanese aircraft hit the attack group in the south. The next day the Japanese covering force were located and taken under air attack, which damaged the carrier Shokaku. The Japanese aircraft hit the US carrier force almost simultaneously. The Yorktown was damaged and the Lexington was set on fire. The Lexington

[49] AJP-01, p.59.
[50] Mine Warfare is also a great contributor to the anti-surface operations. Still, I have described this in the chapter on subsurface warfare due to the fact its weapon and technology is applied in that maritime segment.

had to be abandoned and was sunk. The Japanese aircraft won this naval battle – but they were not able or willing to land on the islands.

In the British case, the Fairey Firefly of the Fleet Air Arm (FAA) and the Beaufighters of the RAF are great examples of important air assets for ASuW. The Firefly made for instance an important contribution in the operations in Norwegian waters in 1944, and is especially well known for their heavy attacks on the battleship Tirpiz. The FAA operated the aircraft till the end of the Korean War. The RAF Coastal Command is mainly reckoned for their anti-submarine effort during the Second World War, but did in fact contribute with offensive air power for blockading German shipping, especially in the Skagerak and along the Norwegian coastline to disrupt the high-grade Scandinavian iron ore. The classical instrument of blockade had been the naval surface fleet, and the use of aircraft in this role had not been envisaged by the British until after the war broke out.[52] Even dough these operations did not have the desired strategic effect of halting the iron ore transport, it is proven that these operations at least tied up great German surface and air forces for protection of this crucially important transport. This in turn was very favourable for both the general aerial bombing operations over Germany as well as for the D-Day campaign.[53]

Other, more contemporary examples of ASuW are to be found with the asymmetric Soviet Navy. During the Cold War, the Soviet Navy had great focus on the ASuW role. Long-range high-performance aircraft armed with sophisticated missiles of the time became a core element of their naval posture from the late 1950s onward.[54] This is still a prioritised and significant capability for Russian military forces and research.

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[51] http://www.history.navy.mil/branches/org4-5.htm , April 2004, p.114-115.
[52] C.Goulter, *A forgotten Offensive. RAF Coastal Command's Anti-shipping Campaign, 1940-1945* (London: Frank Cass, 1995), p.xv.
[53] C.Goulter, *A forgotten Offensive. RAF Coastal Command's Anti-shipping Campaign, 1940-1945*, p.270 and 302.
[54] This is well described later in the case-study.

Today there are three major missile concepts developed for naval air strikes. The traditional missiles are still useful. They are relatively cheap – and may actually hit most targets except for the most modern and larger vessels with effective self-defence systems. Today, hard countermeasures as anti-air missiles and guns, as well as soft systems as chaff and flare defend the larger naval vessels. These targets are difficult to strike by old generation missiles – except if they are launched for a "missile overload" purpose from an attacker or attackers. More modern missiles are either based on low-signature or even stealth to be able to close in on the greater targets – or are being developed to have several times supersonic sprints inwards to the target.

Non-lethal ASuW include all from third party target-reporting to electronic warfare. Third party targeting is a contemporary terminology, but the concept have obviously been around since the birth of air power. The spotting and reporting for gunfire have since evolved to include specified procedures for voice over radios – but also for link systems and the evolving network concepts. All types of communication are used for this purpose, and as missiles got their great ranges during the Cold War, third party targeting became crucially important and necessary. Electronic Warfare includes both offensive and defensive exploitation of the electromagnetic spectrum for the purpose of combat.[55] Jamming, either aimed at electronics, communication or other, is considered offensive – but still non-lethal.

To sum up on Surface Warfare: this is about the all-embracing ASuW concept and maritime interdict for control of the activity at sea. For ASuW, the aircraft armed with missiles have 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 includes *Mine Warfare (MW)* and *Anti Submarine Warfare (ASW)*. Presently and for the next two decades, these are assessed to be the most challenging area

for the greater maritime nations. The air and surface warfare areas are well covered by surveillance and reconnaissance systems – while the subsurface dimension is still a shadow. The USN, which to the greatest extent left this field of expertise after the demise of the Cold War, have now on the contrary gotten the greatest focus on this challenge. It is of concern that other European nations are downscaling their ASW forces today. For instance have the Dutch sold all their MPAs to Germany last year, and the British are constantly decreasing the numbers of the new Mk.4 Nimrod – probably ending up with about 12 aircraft in total. Some of the reason is that the new submarine threat is expected to rise in mainly the Indian Ocean and western Pacific in the years ahead. In the area southern and eastern Mediterranean, the non-NATO countries Algeria (2 Kilo), Egypt (4 Romeo) and Israel (3 Dolphin) have operational submarines. In the Indian Ocean and west Pacific, Iran have 3 Kilo and some capable midget submarines, Pakistan have some eight Augusta and Daphne, India have some 18 more or less operational submarines of the Kilo, Foxtrot and Type-209 (- and not at least have great aspirations of acquiring 4-5 Akula or new generation nuclear multirole submarines), and Indonesia have a couple of Type-209s. In the west of central Pacific, North Korea have 22 elder Romeo, as well as some 60 midget submarines. China – as the greatest power in the region have more than 60 submarines – ranging from one SSBN down to smaller conventional boats.

Theses are the hard facts – but the far greater issue is the spread of AIP technology and smaller conventional submarines there might be produced in relatively short time. There are two great issues: The subsurface dimension is not well covered by existing technology and NATO forces, and there are no way of telling how many smaller conventional submarines or midget submarines there may be posing the threat in 10-20 years. We do know that effective ASW forces and technology takes about this time to establish. Therefore – the USN are doing the right thing preparing for these proposed threats in the future.

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[55] BR 1806 (1995), p.213.

For coping with these threats of subsurface hidden threats, both mines and smaller submarines, the evolving tactical-technological trends are about distributed deployable or off-board sensor network, mainly by multi-static acoustics[56], low frequency sonars – maybe even synthetic aperture[57], as well as search by new evolving non-acoustic sensors.

For mine warfare, organic and autonomous unmanned underwater sensors to detect mine threats are evolving. For the surface ships, self-protective defensive systems against torpedoes are being implemented, but the true capabilities are at the best questionable.

Mine Warfare is divided into two areas: laying of mines, and actions taken to counter the threat of an adversary's mines. Minelaying, or the threat of mining, can either be protective, defensive or offensive.[58] 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 to restrict or channel 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, thus disrupting military and economic supply and naval deployments. Aircraft capable of carrying large quantities of mines have been used for mining by many nations. It is an important capacity of Maritime Air Power, though seldom talked about. During the Second World War, offensive minelaying by British aircraft inflicted significant losses and delays on German coastal shipping.[59] Bomber Command largely carried out this effort. Even though Coastal Command is viewed as the main contributor to the sinking of surface ship – it must be reckoned that the minelaying by Bomber Command both sank greater tonnage as well as were far cheaper on own risk and causalities.[60] The importance of aerial minelaying

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[56] Multistatic: a technological concept of multiple acoustic receivers to detect active echoes or a receiving repeater for detecting the increasing silent submarines.

[57] Synthetic aperture has been used on radar for a decade, and is now being introduced for mine detection and explored for ASW. Synthetic aperture is a computer technology there fuses great amounts of input to create a picture-like signature for recognition.

[58] NATO even devides minelaying in strategic and tactical mining. This is a disperse use of the terms I will not take into academic work.

[59] Naval War Manual (1957/1961), p.65.

[60] C.Goulter, *A forgotten Offensive. RAF Coastal Command's Anti-shipping Campaign, 1940-1945*, p.297.

was also true the other way, where for instance German minelaying of the eastern coast of Britain and the Skagerak actually sank more tonnage than the German submarines during the fall of 1939.[61] The Germans intensified this role of offensive minelaying after the invasion of Norway in 1940.

Mine Countermeasures (MCM) may for aircraft involve actions taken to prevent an adversary from successfully laying mines by attacking adversary minelayers and by traditional mine hunt 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 USN further explores this MCM role with their new MH-60S helicopters. These helicopters are the first to be fully operational with a proven LIDAR[62] system for mine, as well as for ASW search. For the destruction, the helicopters will probably be configured with a gun-system of a special precision 30mm supercavitating projectile[63] to penetrate and destroy surfaced and near surface mines. The technological company Thales has even developed mine-hunt dipper sonars for helicopters. Mine Warfare, especially in the case of minelaying, is clearly an important role for Maritime Air Power, even not too well known or accepted.

Anti-Submarine Warfare: Classical ASW, from the introduction of the convoying system, has comprised operations with the *intention of denying the opponent the effective use of his submarines*. The features of the submarine, amplified by the large numbers of submarines produced by the Germans at first, later the Soviet and USA during the Cold War – have pushed the anti-submarine forces on the defensive. This 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 (MPA), shore-based facilities and friendly submarines. The

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[61] L.Hart, *History of the Second World War* (London: Papermac, 1997), p.387-390.
[62] LIDAR (Light Illumination Detection and Ranging), laser which detects targets at depths between 5-50 meters, depending on the clearity 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.
[63] RAMICS (Rapid Airborne Mine Clearence System).

complexities of such co-ordination, and the special environmental factors involved, have made the submarine threat one of the most difficult problems to counter.[64]

I will argue that this classical *defensive ASW* must come to an end as the prime perspective. For the limited wars of today and future conflicts between asymmetric forces – the greater nations must aim for an offensive ASW approach. By *offensive ASW* I mean operations aiming to find and neutralise or control the enemy submarines before they can constitute a threat. This has to a limited degree existed, but not in the main naval concepts – but more as a secret part of the Cold War with the triad of SOSUS[65] and intelligence ships in co-ordination with the offensive capabilities of hunter submarines and ASW aircraft. The US Navy has introduced a contemporary term "hold at risk" which well describe – and can be used about offensive ASW. A great maritime power today must be able to achieve full control with the limited numbers of submarines of smaller nations. *Go out and search for, and know their location at all times for achieving sea control – this is to "hold at risk" in offensive ASW.* The conventional smaller, yet powerful submarines are placing a significant threat to the greater democratic nations. Not so much as an equal combatant (mainly because of the small numbers) to stop military forces in total, but political overthrow the willingness of a state or alliance to accept the loss of one or a few of the naval or commercial ships. In today's global political and media world, the few and small conventional submarines have gotten a far greater relative importance – almost strategically. Therefore, it must be possible for the greater nations and alliances to apply offensive ASW concepts to seek out and control the limited numbers of submarines of the asymmetric adversaries for safe access to the littorals and ensuring a strategic safety of own military and significant civilian shipping. This issue of offensive ASW operations raises the delicate question of pre-emptive actions against a potential capability of another state. If one

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[64] AJP-01, p.59.

[65] 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

should choose to neutralize a submarine "held at risk" – this will of course 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 "hold at risk" are not about destroying (in peace or crisis) enemy forces – it is about knowing the position and status of the enemy. By use of maritime aircraft and satellites with long-range cameras and SAR (radar), or even Humint – one may even achieve control, just by detecting the enemy forces at port. If they leave port, deployable surveillance systems, hunter submarines and aircraft must try to hold contact, and if they do – the commander at sea does have control of the enemy. Today, most forces do not have such capable ASW systems necessary – but they are on their way. Acoustic multistatic sonobuoy systems from aircraft as the Nimrod and new powerful dipper sonars as the Merlins FLASH will be valuable, but not enough. The British forces should probably explore other sensors, e.g. LIDAR. The LIDAR system may give a immense complimentary capability for the littorals, as it detects or presses the submarine below the layers – and thereby enabling the new powerful sonar systems to do their job.

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.

As for the history of ASW, the submarine became a true military reality from the early 1900s with the US submarine Holland (at least to the extent that there evolved thoughts of an anti-submarine concept). By the First World War, several nations had acquired these weapons. From this day, the submarine and the anti-submarine aircraft and surface ships have been locked into a chess game, where one anti-submarine innovation has lead to technological or tactical changes by the submariners.

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detection systems were operational by early 1950s. (http://www.fas.org/irp/program/collect/SOSUS.htm) , April

The submarine and ASW grew mature during the Second World War. In an early battle, the German U-9 sank three British cruisers in just one hour.[66] The surface forces lacked capabilities against this threat. Soon the convoying system emerged and aircraft were successfully deployed in search for the submarines. Still, the sensors were limited – the sightings were mainly visual. For the surface ships the active sonar improved and became a true operational and usable asset. By late 1930 the British had some 220 sonar-equipped combatants.[67] Still, these had not longer ranges than approximately 1500 yards for detection[68], and were consequently effective for convoy type of ASW. The aircraft were the assets there could go out to search for, detect and hunt the submarines. For the initial years of the Second World War, visual search in relation to convoying or as a follow-on from intelligence was the reality. Consequently, the submarines just had to change tactics to avoid these threats. During the war the aircraft radar was implemented to find fully surfaced submarines at night and in bad weather. This was a significant step forward, as the submarines were in fact boats that operated below the surface for the attack-phase. The next main step was the introduction of snorkel for the submarines. The Germans introduced this towards the end of the war, but it did not become a standard submarine fleet capability till after the war. They were no longer required to surface for charging their batteries. The first use of sonobuoys and magnetic abnormality measurements (MAD) had also become a reality towards the end of the war. Still, they were not any significant tactical capabilities in its early stages.

From the 1950s on, in addition to the earlier introduced snorkels - great advantages in submarine design, improved batteries and propulsion systems came along. The submarines became war-machines that generally stayed submerged, except for charging its batteries. The earlier developed sonobuoys had to be improved – and soon became the main sensor for detecting the submarines. From the 1960s, nuclear submarines became operational in large numbers, and

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2004.

[66] J.Morgan and P.Thurman, "ASW – Patterns of History" in *Maritime Patrol Aviation*, September 1997, p.41.

[67] J.Morgan and P.Thurman, "ASW – Patterns of History", p.42.

[68] L.Hart, *History of the Second World War*, p.392.

proposed a new great focus area of maritime warfare. They could now take on the naval surface forces in combat, and not just avoid them for attacking the sea lines of communication.

John Morgan and Pat Thurman present the historical periods of ASW in an interesting figure.

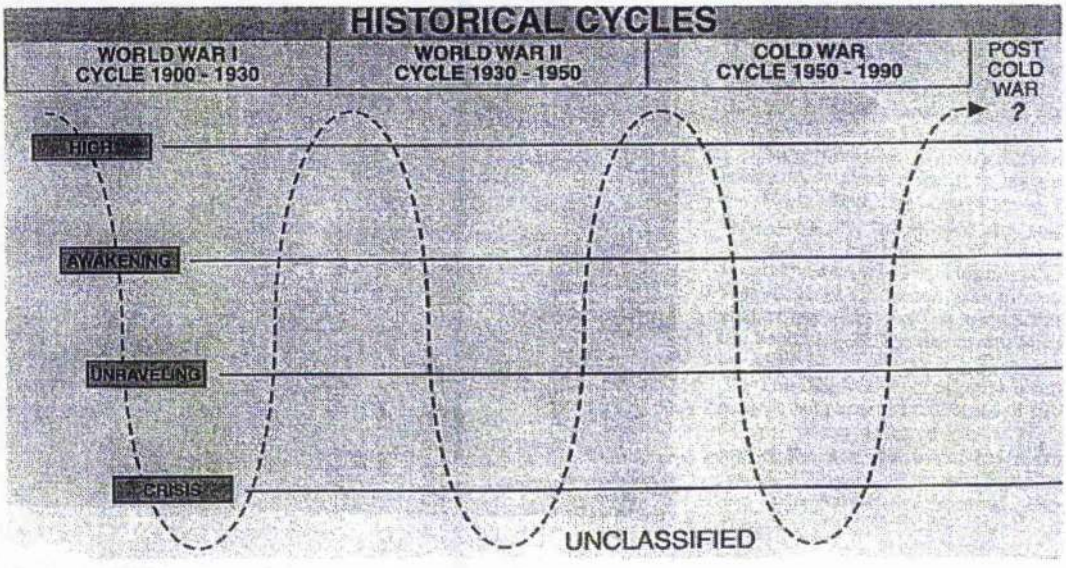

Figure 2: Historical Cycles of ASW (Morgan and Thurman, 1997).

They point out three cycles of ASW where the submarine has been superior, or represented too great a threat. It is quite clear that the nuclear submarine build-up in the 1960s was a serious problem. These cycles are not limited to ASW, but all military development goes through cycles as these, where technology evolves, and counter-technology and tactics come to answer the new threat. Today the ultra quiet conventional submarines equipped with Air Independent Propulsion (AIP[69]) are leading the ASW forces to develop new technology and tactical concepts to cope. The ASW systems for this threat are more or less on their way – but a new cycle will soon evolve…

[69] AIP – Air Independent Propulsion. A technology giving diesel submarines the ability to stay submerged for about a month. The technology is likely to be included in all new diesel submarine programs. It may be exploited by better batteries or by the Sterling engine carrying liquid oxygen – but normally a combination of the two.

As we see, Maritime Air Power has been important in ASW all from the beginning – both in direct support of surface forces and independent in larger area operations. These operations have been conducted with both naval organic aircraft and land based aircraft.

The advantage of the *organic aircraft* is obvious in direct support operations to a specific surface force. It is easily available to the surface commander wherever the fleet need to be and is very much close integrated in the tactics and culture of the mother surface ship. The disadvantage has been its size, earlier both for adequate equipment, crew and endurance. Last generation organic ASW aircraft are significantly more capable in terms of smaller and more effective technologies. Today the small crew is the limiting factors for being able to exploit all technological advantages possible.

The *land-based aircraft* has the advantage of great size, and consequently a bigger crew capable of fully exploiting all technological capabilities for ASW – and even take on other roles at the same time. There are independent and focused crew-operators on radar, sonar, various signal intelligence systems and the full range of communication systems. The aircraft have great range and endurance. It may give direct support to a surface fleet, but also operate solely independent, or in co-operation with other forces as submarines and intelligence vessels. The main disadvantages of the land-based aircraft are most obvious for small and medium forces, where the constant availability is hard to achieve over time. This is not a problem for the greatest powers or alliances. As for range, the larger land based aircraft may have limitations as experienced with the gap in mid-Atlantic for the early stages of Second World War. This is not a relevant problem in the very most scenarios, when most of today's aircraft have the range needed. Another disadvantage is the fact that they may not be so well integrated in the fleet operations, both for the tactics and manoeuvres – and not at least the culture.

Since the end of the Cold War, ASW has not been prioritised among the greater nations. The focus has switched to land operations against smaller nations. The large-scale conflicts among

maritime nations have not been foreseen. Today, the US are trying to regain their ability in subsurface warfare. They do not have the capability to control this medium as they do with the rest of the battlefield. In addition great advances have come across with affordable AIP submarines and sophisticated mine systems, as well as Unmanned Underwater Vehicles (UUV) and Autonomous Underwater Vehicles (AUV). Subsurface warfare is likely to become an expanding field of military threats and operations for the next two decades.

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 category 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. The naval organic and land based combat aircraft has an important role for achieving the necessary degree of air control for other maritime forces to function. In perspective maritime warfare, the approach to air control is though defensive. The aim is seldom air control *per se*, but denying all enemy air activity to be able to freely use own maritime capabilities. Therefore, Air Defence (AD) is the common term used, and it is by NATO defined as "all measures designed to nullify or reduce the effectiveness of hostile air action".[70] As an integral part of countering air and missile threats, air defence operations seek to achieve the appropriate level of control of the air, and thus the protection of the force.

In naval circles and concepts in NATO, the term Anti Air Warfare (AAW) is used for the defence of friendly forces in the maritime environment, against all air-threats posed by aircraft and weapons launched from air, land, surface, or sub-surface platforms.

Contemporarily AAW is done by a principle of "layered defence". Obtaining early warning by passive means as intelligence and signal interception as well as long-range air surveillance radars from ships and aircraft. The organic AEW aircraft has in the maritime theatre an especially

important complimentary 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, complimented by medium-range missile systems. The short-range systems of missiles and guns are for self-defence. This is further complimented by chaff and flare systems, and in some instances active jammers against the 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 solely for self-defence of a unit, are not to 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- 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. These operations are labelled *Defensive Counter Air* operations. By all these different capabilities and tasks 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.

Interceptor aircraft have also been a critical capability from the Second World War onward. They had the role of cutting off the advances of bomber aircraft. During the Cold War many aircraft were optimised and designed as interceptors, and not just being combat aircraft operating in the role of interception. Still, all interceptor and fighter aircraft had poor radar performances for air interceptors and combat[71] all the way up to the 1970s, and were crucially dependent on being directed roughly on the targets from ground stations for intercept. For the air-air dogfight, visual sightings were still often the reality. One interesting concept of the Soviet air defences

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[70] AJP-01, p.96.

was the integrated air-launched missile intercept system[72] developed with second generation interceptors as the Yak-25P, Yak-28P as well as Su-9, 11 and 15.[73]

The concepts of Air Defence – or AAW are interesting for examining the crossing-lines of air and sea power. It is clearly a role of air power, but it obviously also has a maritime objective for defence of- and as a pre-requisite for all other maritime operations to take place. The crossing-line can be exemplified by the different use of terminology. In naval concepts, Air Defence is viewed as an integrated part of the overall AAW – while on the contrary AAW is viewed as an integrated part of the greater Air Defence effort by the concepts of the air forces. Still, the supreme statement from the official NATO joint doctrine is that "AAW is part of the overall Air Defence effort".[74]

To achieve Command of the Air and any extensive degree of area air control in the dimensions of time and space – air power is normally most effectively used in more offensive concepts. We are then discussing *Offensive Counter Air* operations, such as attack on airfields, aircraft logistical facilities and suppression of enemy air defences. We are then moving the discussion on use of air power over into *ordinary air power theory* – and this may be viewed as a natural limit or grey area between sea power and air power concepts, theory and doctrines. We have successfully identified another crossing-line between Maritime Air Power and general air power.

For a historical view on Air Defence, both naval and land based early air warning started out with visual observation, but was revolutionised with the British in the early stages of the Second World War. The radar surveillance paired with a effective Command and Control system was probably the one' most decisive role in the Battle of Britain. Soon radar air surveillance became a standard and necessary capacity and role for all countries - both for land, air and naval forces.

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[71] Aircraft radar could detect air targets up to 3-4 km from the 1960s (P.Podvig, *Russian Strategic Nuclear Forces* (Cambridge: MIT Press, 2004), p.409).

[72] Missiles being launched by interceptor aircraft, but receiving mid course guidance by the radar stations. There is still great uncertainty of the effectiveness of such systems.

[73] I.Sutyagin and P.Podvig, *Russian Strategic Nuclear Forces*, p.409. Note: In addition the Mig-21 is reckoned as the same generation interceptor, but it differs in the way they were converted from air force combat aircraft.

After the Second World War, with the evolving Cold War with the strategic nuclear bombers as the main weapon – technology in this field of land based early warning against the air raids rapidly improved. The Soviets distinguished themselves with the development of low frequency (VHF) radars from the early 1950s.[75] The advantage of this technology was its long-range capability. For example did the elder system P-14 Lena have detection ranges of 500-900 km.[76] The Russians have stayed with this technology, where these systems today give great ranges, even against low-flying targets – and not at least the capability to find and track low observable (stealth) targets.

The importance of Air Control Warfare became crucially clear with the maritime war of the Pacific during the Second World War. The Japanese and US forces were both very capable and balanced – and the fight for air control by use of air-combat aircraft was perhaps the most significant principle role for deciding the outcome of the war. The Japanese attack on Pearl Harbour proved the lethal effect of large air strikes against naval surface forces. One may argue that the fleet was not able to defend herself in-shore – but in fact the only capable weapon against large air strikes were other aircraft. The guns of the surface ships were not capable of effectively fighting off large numbers of aircraft. For the Pearl Harbour case, one may probably conclude that luckily the ships were in harbour, so most of the crew survived.

The occupation of the Gilbert Islands in 1943 gives good examples of both offensive and defensive use of air power for air control. Task Force 50, with six heavy carriers and five light carriers, opened the campaign with land attacks on the Japanese airfields and defences. This offensive use of air power had the purpose of reducing the capabilities of the Japanese to use their landbased air power. Following this offensive air operation – the US carrier aircraft

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[74] AJP-01, p.58.
[75] The P-15, P-19 (soon replaced by 39N6 and 35N6) and P-20, VHF-band radars were operational from early 1950s and made the basis of many radar systems there has been operational till present. The first jammer resistant radar, the P-8, was also developed in the 1950s (I.Sutyagin and P.Podvig, *Russian Strategic Nuclear Forces*, p.401).
[76] I.Sutyagin and P.Podvig, *Russian Strategic Nuclear Forces*, p.401.

continued with defensive air operations, or combat patrol, for covering the landings of the Marine and Army troops.[77] This operation also saw the first attempts of night interceptions from carriers. Two Hellcats operated in formation with one radar-equipped Avenger from the Enterprise. The formation was first directed towards the area of the Japanese aircraft from the ships. The Avenger then spotted the aircraft on its radar (at short range) – and directed the Hellcats into visual nighttime detection. This was a significant achievement for all-day protection of the surface forces. A few months later, with the occupation of the Marshall Islands in January-February 1944, night fighter detachments of F6F-3s and F4U-2s equipped with AIA radar were used against the feared Japanese night raiders. The crew learned how to use the equipment in short time, and on the 23 February the two carrier groups of Task Force 58 were able to fending off a series of determined night air attacks.[78]

There were in fact numerous important air battles in the war of the Pacific. The *landing at Hollandia* (21-24 April 1944), the *occupation of the Marianas* (11 June – 10 August 1944), the *occupation of Palau and Morotai* (31 August – 30 September 1944) and not at least the *occupation of Leyte* (10 October – 30 November). During a five-day campaign the 17 carriers involved destroyed 438 Japanese aircraft in air combat and 366 on the ground. Towards the end of the war, the *invasion of Luzon* (3-22 January 1945), the *capture of Iwo Jima* (16 February – 16 March 1945), the *Okinawa Campaign* (18 March – 21 June 1945) and finally the operations against Japan until 15 August 1945 are all great examples of air control and strike warfare.

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. This focus must be retained by all maritime nations.

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[77] http://www.history.navy.mil/branches/org4-5.htm , April 2004, p.131-132.
[78] http://www.history.navy.mil/branches/org4-5.htm , April 2004, p.136.

Force Projection - a "fifth" core capability

Force projection is a fifth core capability. It is about using military forces for strike by fire-power towards land, amphibious warfare.[79] Both the NATO doctrines and the British maritime doctrine states that this is about using sea based military forces to actually influence on the land-war itself. In most cases, this has no aim of any maritime objectives. Force projection still is a prioritised task out many navies, and we are consequently moving into a hazy area of objectives, reason and responsibility between the three military services (and maybe even a fourth part-service - the "Marines" territory). Some of the operations of force projection will probably be within the scope of Maritime Air Power, while others will not.

Effective *amphibious operations* are important for the safe and timely delivery of seaborne forces at a coast objective. Access to the littorals and coastlines have historical importance, e.g. with the landing 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 important both for opening a new front and for logistical support by sea.

Amphibious operations did lose much of its influence or focus in the greater Cold War play – but has again gradually become the prime focus of the larger maritime forces over the last decade. 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 and finally introducing the "Sea Power 21" concepts. The three focus points of the last concept have become Sea Basing for assuring access, followed by Sea Strike with offensive force projection, and not at least the defensive objectives and offensive nature of Sea Shield. These operations require in addition to the obvious transport support, defence of shipping (ASW, AAW, ASuW and MW) and control of ship-to-shore movement either by surface craft or helicopter. There are

[79] In addition, Non-Combatant Evacuation Operations (NEOs) is a role of force projection.

in NATO four types of amphibious operations[80], which show the width of this field: *Amphibious assault, amphibious withdrawal, amphibious demonstration* and *amphibious raid.* Amphibious assault is the principle 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 *firepower strikes* against targets ashore using carrier-based strike aircraft, sea-launched cruise missiles, as well as classical naval guns.[81] 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 strike 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 strike against targets out at sea, requires more an understanding of air strike in general. Land avoidance, tactical flying for disguising in the terrain, continues 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 the ships in harbour, production and repair facilities and oil supplies.[82] This should clearly be reckoned as Maritime Air Power.

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[80] AJP-01, p.66.

[81] 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 of ordinary naval guns – and are GPS guided. With the evolution of electronically railguns with 155mm canons – ranges of 200nm are proposed. This may give the gun-ship a re-birth…

[82] Naval War Manual, (1957/1961), p.65.

Discussing strike against targets out of the immediate naval support facilities and harbours, the theories and concepts of sea power may not longer be best suited to describe all elements, even though the aircraft may be operated from carriers. General air power theory comes into play. This is a crossing-line between Maritime Air Power, which is about maritime objectives, and general air power concepts. Force projections from ships towards 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 organisational rather than object based description.

Section two: Case-study

Maritime Air Power of Britain, 1957 – 1967

The conceptual framework made in the previous chapters will be used for the following case study on the British forces at the height of the Cold War. My hope is that by using this comprehensive and conceptual cross-service framework it will be easier to identify all the elements of Maritime Air Power by reason or roles – as an alternative to the normal approach of describing aircraft and carriers or naval and air services.

For this more specific case study, it is first necessary to look at the strategical framework of the era, as well as the threats that were dimensioning for the balancing of the British forces. This obviously makes the foundation for the maritime objectives of the forces, but also to a degree directs the operational requirements for the aircraft and military systems.

The strategic framework

The strategic framework of Britain in this era included the status of the Cold War at the time and the following developments of NATO doctrines – as well as the technological capabilities and the assessed strategic interests in the region by the Soviet Union. This will be described in the following chapters, before studying the British forces in this perspective.

NATO – from Massive Retaliation to Flexible Response

From the start in 1949, NATO was founded on a strategic concept based on maintenance of large conventional forces easily available along its central borders. In order to achieve this, NATO agreed in Lisbon in 1952 to field almost 100 divisions within two years.[83] It soon became clear that the European countries neither had the political will or the economic strength to achieve this goal. During the initial years of NATO, also great evolutions were achieved in nuclear weapons. The US had used their first in Japan, while the other side of the emerging front, the Soviets,

[83] http://www.globalsecurity.org/wmd/library/report/1986/LLE.htm , April 2004.

detonated their first atomic bomb RDS-1 on 29 August 1949.[84] Still, the Soviet Union did not have their first mass-produced bomb delivered to the Long Range Aviation until 1953. Development for use of this immense technology was rapid. By 1954 the Soviets had used the technology to develop the first tactical nuclear bombs and soon after the same warheads were used in long-range missiles, and by 1955 the first nuclear warhead was successfully tested with the T-5 torpedo for the Navy.[85] For their Air Force, even air defence systems came available with tactical nuclear warheads.

The US detonated their first hydrogen bomb or thermo-nuclear bomb in 1952 – followed by the first Soviet thermo-nuclear test in 1953. Soviet Union had their first mass-produced thermo-nuclear bomb operational from 1955, and a family of the bombs was fully available by the late 1950s.

In late 1953 the US unilaterally began to deploy nuclear weapons on the European continent, which gave the US a first strike capability over the Soviet Union until the late 1950s. The Soviet long-range aviation was not capable of large attacks against the US, but the launch of Sputnik on 4 October 1957 changes the balance.

As of all this development, the US officially stated a new strategic posture based on "Massive Retaliation" in 1954. The concept of Massive Retaliation implied that the conventional forces were used in a "trip-wire" role. The Soviet, or later the Warsaw Pact[86], had to fully mobilise to go through the conventional forces. This would give the US, or NATO, the opportunity to strategically attack with nuclear weapons. NATO immediately started considering the new strategy. It was very tempting, primarily because the immense high level of conventional forces the initial NATO strategy required had been both economically and politically unfeasible. NATO

[84] P.Podvig, *Russian Strategic Nuclear Forces*, p.72.
[85] The test of the T-5 on 10 October 1955 included a 10-kiloton nuclear explosion at a depth of 35 meters, only 10 km from the submarine! (P.Podvik, *Russian Strategic Nuclear Forces*, p.73).
[86] Warsaw Pact Soviet-led Eastern European defence organization established in Warsaw, Poland, on May 14, 1955; the alliance countered the U.S.-led NATO.

officially adopted this strategy of Massive Retaliation by the end of 1956 with MC 14/2. But, all from the beginning there were great concerns in Europe that the continent would be a devastated battlefield of tactical nuclear weapons used by both the Soviet and the US forces. Still, the main reason for the US taking the lead towards a new strategy for use of nuclear weapons were that the credibility of the strategy was challenged. The Soviet developments in rocket and nuclear technology were rapid, and the first strategic nuclear SS-3/R-5M missile was fully and successfully tested on 21 June 1956.[87] By modern definitions, the missile would be considered "intermediate-range" with its 1200km range. Then all Soviet resources were put into making an intercontinental ballistic missile (ICBM) capable of hitting the US. The newly established Strategic Rocket Forces (RVSN) accepted the first ICBM, the R-7 (SS-6) missile, on 17 December 1959.[88] New and improved missiles, as well as silos were developed during the first half of the 1960s.

The consequence of these developments was immense for the maritime theatre. It made the large fleet of long-range and high performance strategic bombers superfluous in its original role. This in turn had great impact – when large numbers of these aircraft were transferred to the Soviet naval air arm for strike purposes. The British forces consequently had to counter a high performance fleet of long-range strike aircraft armed with conventional and nuclear bombs and missiles.

The early critics of the strategy of Massive Retaliation soon got support in lieu of the Soviet developments in nuclear and rocket technology. In the US the critics of the Eisenhower administration introduced the term "Missile gap". It was claimed that the US had fallen behind the Soviet Union in the production of nuclear missiles, especially in case of ICBMs. Both in case of the USA and the Soviet Union, few questioned that a future war between the superpowers would happen without this quickly expanding to a nuclear war. Sokolovskiy says, "If nuclear

[87] P.Podvig, *Russian Strategic Nuclear Forces*, p.120-121.

weapons are not destroyed and if the aggressors unleash a world war, there is no doubt that both sides will use these weapons".[89] Further Sokolovskiy stated that nuclear weapons could be used in a modern war to solve strategical, operational as well as tactical tasks from a military point of view. The Soviet missile threat was clearly potential, but still, it may well have been exaggerated. The period between 1958-1962 especially saw many confrontations between Soviet and the West, and Soviet leadership – all from official speeches, through articles, as well as "official" writing by e.g. Gorshkov and Sokolovskiy tended to underline this success in missile technology – probably as a source of fighting the overall and genuine lead in technology from Washington.[90]

Nuclear weapons had become "… an 'inflexible tripwire' instead of an asset".[91] For military development this was an *important maturing period for dealing with the menace of the new technologies*, but it was time for new strategies. The discussions started already in the early 1960s in the US -- and the strategy of Flexible Response was officially expressed under Kennedy by 1962.[92] NATO officially adopted the new strategy of flexible response in 1967 with MC 14/3.

The era of Massive Retaliation must be viewed as an interim, or immature early nuclear strategy. As soon as both sides had credible capabilities of mutual assured destruction (MAD[93]) – all the historic and general military principles had to be embraced.

Three levels of Flexible Response were described: "Direct defence" was about seeking out the enemy to defeat him at a conventional level. If the conventional direct defence should fail, the plans were to go to the next level of "deliberate escalation". At this level tactical nuclear

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[88] P.Podvig, *Russian Strategic Nuclear Forces*, p.121.
[89] V.Sokolovskiy, *Soviet Military Strategy, third edition* (New York: Crane, Russak & Company, 1968), p.193.
[90] J.Mathers, "A Fly in Outer Space; Soviet Ballistic Missile Defence during the Khrushchev Period" in The Journal of Strategic Studies (Vol.21, nr.2, June 1998), p.54.
[91] M.J.Armitage and R.A.Mason, *Air power in the Nuclear Age, 1945-82*, p.192.
[92] http://www.globalsecurity.org/wmd/library/report/1986/LLE.htm , April 2004.
[93] The MAD (Mutual Assured Destruction) refers to a Cold War theory in which the United States and Soviet Union each used its ability to launch a nuclear counterattack to deter a first strike from the other side.

weapons were intended used for causing the attacker to cease the conflict and withdraw from NATO territory. Should this fail; the last resort was to go to a "general nuclear response".

For this to be credible and for ensuring the new strategic postures, the capabilities of NATO required or were based on three pillars:

> *... an assured second-strike retaliatory nuclear capability based on a triad of land, sub-surface and air-launched nuclear weapons; close control of tactical nuclear weapons; and increased and more mobile conventional forces. ...for a flexible range of options and the ability to escalate by tight control from minimal conventional to maximum nuclear.*[94]

The strategy implied that NATO needed to prepare for limited incursions. No longer could one rely on deterrent "strategic nuclear attacks" from heavens of local-control at land or sea. The maritime forces would have to do more than protecting the nuclear strike-forces in a full-scale war. Maritime Air Power, as the other forces, again needed to be balanced for the fully and wide range of roles under flexible response. In the maritime theatre NATO would have to protect its flanks and immediate coastal waters. Under Flexible Response classical maritime tasks of protection of Sea Lines of Communication (SLOC), as well as anti-invasion or home defence became crucial – once again. Further the strategy of Flexible Response demanded a pre-hostilities mobilisation of forces for surveillance and quick response.[95]

This era of Flexible Response of 1967 lasted out the Cold War – and practically still does for the use of nuclear weapons.

Soviet Union as a potential threat to Great Britain

The Soviet forces constituted the only true and direct threat to the British Isles, and are consequently viewed as the dimensioning forces for the balancing of the British forces – the British Maritime Air Power forces included.

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[94] M.J.Armitage and R.A.Mason, *Air power in the Nuclear Age*, p.193.
[95] J.Sokolsky in J.Hattendorf and R.Jordan ed, *Maritime Strategy and Balance of Power* (New York: St.Martins Press, 1989), p.306-308.

The Soviet surface naval force build-up was great after the Second World War under Stalin and Kuznetsov, with its heights with the feared Sverdlov class. The submarine build up was great all along, but especially from late 1950s submarine nuclear propulsion, nuclear torpedoes, as well as ballistic and cruise missiles made the threat immense. This threat became one of the most significant of the entire Cold War play. The threats posed by the long-range strike aircraft have in my view gotten disproportional little attention. In the following few pages I will elaborate on the submarine and strike aircraft threat there faced the British Isles and NATO from the northeast. This understanding of the Soviet subsurface, surface and air threats are crucially necessary background to understand the British balancing of the Maritime Air Power forces.

The Soviet threat – the forces

The Soviet submarine developments

In September 1955 the Soviet Navy launched their first nuclear-capable missile at sea from the conventional Zulu-class submarine, an event that put a new revolutionary standard to naval warfare.[96] The Soviet Navy built a powerful and feared Navy based on a large submarine fleet. It may be characterised as both asymmetric and alternative – but it was very much balanced to its tasks. It is necessary to give a brief description of this force, to be able to understand or evaluate the disposition of western forces.

By the mid 1950s the Soviet Navy had started their building programs for obtaining a classic and powerful submarine fleet, but development in missile and nuclear technology by the late 1950s did change the fleet's capabilities drastically. The *Whiskey-class* diesel-electric submarines were classical medium-range patrol and torpedo-attack submarines (SS). They were produced in large numbers, and the class was operational from 1950 till the 1980s. There were initially produced Whiskeys I through V. The *Zulu-class* diesel-electric patrol and attack submarines were in

[96] E.Grove and G.Till in J.Hattendorf and R.Jordan ed, *Maritime Strategy and Balance of Power*, p.29.3.

service by 1952, and in addition a *Quebec Class* diesel-electric was developed for coastal patrol, and was in service by 1954.

The great changes came with the revolutionary *Zulu IV ½*[97] and the following five *Zulu V* class boats were converted from earlier Zulus in the late 1950s. From the second boat on, they were armed with two SS-N-4 SLBM[98] missiles in addition to the torpedo tubes.[99] In addition two new versions of the *Whiskey-class* called *the Long Bin* and *the Twin Cylinder* came by 1959-60, armed with the first submarine cruise missile, the P-5 (SS-N-3 Shaddock).

In Britain, the Zulu- and Whiskey-class submarines were assessed more capable than the British conventional hunter submarines.[100]

About the same time, the *Golf-class*[101] diesel-electric appeared. From 1958 to 1962, 23 missile submarines of this class were built, and they were fitted with the SS-N-4 from the beginning.[102]

Two other classes of conventional patrol and attack submarines (not equipped with missiles) were built in the following few years. The *Foxtrot-class* came in service from 1958, and consisted of 62 boats for Soviet use. The *Romeo-class* came in service the same year, but only 20 were built. In 1962 a new and more specialised diesel-electric submarine came into service, the *Juliett-class*. It was to carry the Soviet Union's first cruise missile, the new P-5, and an increased torpedo load.

The drawback of the conventional submarines was clear. On patrol out in open ocean they were very vulnerable to ASW aircraft while charging their batteries. Nuclear propulsion was being

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[97] E.Miasnikov in P.Podvig ed, *Russian Strategic Nuclear Forces*, p.x of tables and p.283.
This Zulu IV ½ fired the first nuclear missile from the White Sea to a test range on the Kola Peninsula on the 16 September 1955 (E.Miasnikov in P.Podvig ed, *Russian Strategic Nuclear Forces*, p.237).
[98] SLBM: Submarine launched ballistic missile.
[99] The SS-N-4 had initially a range of 250 km, and 150 km when carrying a nuclear warhead.
http://www.fas.org/nuke/guide/russia/slbm/611AB.htm , April 2004.
[100] They were assessed to have a submerged capability of 90hrs at 4kts and 25hrs at 6kts.
[101] It was a Golf I that was lost in 1968 off Hawaii, and later partially salvaged by the USN/CIA in 1975. This was a spectacular story known as "Project Jennifer".
[102] The latest versions of the Golf class had up to 540-600 km range for the improved SS-N-4 missiles.

explored, and the *November-class*[103] became the first Soviet nuclear-powered submarine. It was in service by April 1958, and 14 submarines were soon built. The November-class only carried torpedoes, but as the first Soviet nuclear submarine – it was significant.[104]

The basic design of the Novembers was used to create the first nuclear strategic submarine, the *Hotel-class*. The first of this class, the K-19 was commissioned at the end of 1960.[105] The *Echo-class* cruise missile submarine soon joined as a complimentary to the ballistic missile *Hotel-class*. The first *Echo I* was in service by 1960, and was armed with the P-5 cruise missile and had 6 torpedo tubes for Type 53 torpedoes, as well as 4 torpedo tubes for Type 40 torpedoes. The *Echo II* entered service in service 1962, armed with the P-6[106] anti-ship and coastal-strike cruise missile (The P-6 was in NATO given the same name as the P-5 – the SS-N-3 Shaddock) and the same torpedo configuration. The submarines carrying these first generation missiles, with their relatively short range and the need to surface for the launch, made the submarines very vulnerable to air ASW forces. Projects in creation of missiles with underwater launch capability resulted in the SS-N-5 Sark SLBM missile. It had a far greater range[107] and were able to launch from depths of 40-60 meters.[108] Many of the earlier submarines were refitted with the D-4 system to launch these missiles from 1963 to 1967.

This was another significant development for maritime warfare – where the submarine had become both nuclear powered as well as able to launch long-range missiles submerged.[109]

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[103] It was named Leninskiy Komsomol, and was launched on 09 August 1957. The boat's nuclear reactors started for the first time on 04 July 1958, and on 17 July 1962, K-3 was the first Soviet submarine to reach the North Pole. Several units of this class suffered reactor accidents.

[104] In 1968, a Soviet November class nuclear submarine surprised the US Navy by keeping pace with a high-speed (31-knot) task force led by the nuclear-powered aircraft carrier Enterprise. The next year, responding to the "November surprise", the US Navy initiated development of the new "Los Angeles" class of fast attack boats (http://www.globalsecurity.org/military/world/russia/627.htm) , April 2004.

[105] It was political prestige that pushed the early deployment of K-19, which nearly ended in a nuclear melt down of the Norwegian coast after a collision with the US *Gato* submarine.

[106] E.Miasnikov in P.Podvig ed, *Russian Strategic Nuclear Forces*, p.238-239.

[107] Ranges of about 1400km.

[108] E.Miasnikov in P.Podvig ed, *Russian Strategic Nuclear Forces*, p.237-238.

[109] Further: During the second half of the 1960s, new powerful classes nuclear submarines became operational. The *Charlie-class* cruise missile submarines, of which twelve Charlie I submarines were built from 1968. It was equipped with the short-range anti-ship SS-N-7 Starbright and 6 torpedo/launch tubes for the missile-torpedo SS-N-

In the case of the ballistic-missile submarines, the US had a great lead with their *George Washington class* Polaris submarine. The Polaris system was operational by 1960, and influenced NATO as well as Soviet strategies and tactics, as well as the technological development. These second-generation missiles ensured a true second-strike capability.[110] The Soviet answer to this weapon system was the *Yankee-class* ballistic missiles submarines (SSBN). There were built 34 *Yankee I* between 1967 and 1974.[111] This first true Soviet strategic submarine was armed with 16 SS-N-6 Serb SLBM with a range of 2400 km.[112] – but even with this range, the strategic submarines had to move out of the Barents Sea to their combat patrol areas and strike position. The bastions of the Barents did not become a reality till after the SS-N-8 Sawfly[113] SLBM entered service with the *Delta-class* in the early 1970s. Until then the Soviet submarine fleet had to penetrate the ASW lines of the Norwegian Sea and the Gaps.

The Soviet strike aircraft developments in the 1950s and 1960s

This is an underestimated focus in military philosophical and historical literature. Soviet naval access to the Atlantic is stressed as the main threats of the Soviet Union in much naval literature. The reaches of Soviet air power, both for strikes against maritime targets and land targets along the flanks of Europe, have not been given its rightful attention. The well-balanced and capable land based air power of the Soviet Union would have seriously displaced the power balance of Britain and Northern Europe operating from the Norwegian coastline.

One of the few who noted this crucial threat was Jonathan Alford, former Director of the International Institute for Strategic Studies. He said about maritime operations.[114]

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15 Starfish or Type 53 torpedoes. The *Victor-class* attack submarine came along in 1967, of which 16 *Victor I* were built and equipped with 6 torpedo/launch tubes for SS-N-15 or Type 53 torpedoes. This class had greater performance than the rest of the fleet, and is still operational with the Victor III batch in the Russian Northern Fleet.

[110] The system had initially ranges of about 2200 km.

[111] http://en.wikipedia.org/wiki/Yankee_class_submarine , March 2004.

[112] E.Miasnikov in P.Podvig ed., *Russian Strategic Nuclear Forces*, p.240.

[113] The SS-N-8 had a range of 7800 km, and the Bastion strategy soon became a reality. By 1975 the missile had even been tested launched from the piers.

[114] J.Alford in G.Till, ed, *Britain and NATO's Northern Flank* (New York: ST.Martins Press, 1988), p.77.

"In part this is about the Soviet interdiction of the trans-Atlantic routes; in part this is about the Soviet need to keep NATO naval forces well away from important Soviet assets; and in part it is about the reinforcement by the sea of the NATO north – and all are interconnected."

He then concluded:

> *I will assert that it is the Norwegian airfields which are – or ought to be – of greatest concern. I suggest the following syllogism: who controls the Norwegian Sea depends on who controls the North Norwegian airfields: who controls those airfields depends on who gets there first: and who gets there first depends on who controls the Norwegian Sea.*

For the Soviet Union being able to control this area, or at least deny it to the NATO forces, the most important task of the Soviet fleet and aircraft from the very outset of a war would be to destroy enemy striking carrier-based units. The Soviets expected that NATO ASW ships, as well as ASW and air defence aircraft would protect the attack carriers. Still, they were strong in their belief that those forces and weapons could not effectively defend the vulnerable carriers from the Soviet submarines and aircraft armed with long-range missiles. Sokolovskiy stated:

"... our fleet of missile-carrying submarines and aircraft permit approaching the aircraft carrier to the distance of missile launch without entering the zone of antisubmarine and air defence of the attack carrier force".[115] To be able to do this, the geo-strategic importance of northern Norway stressed by Alford in the above scenarios is quite clear.

The Cold War Soviet medium- and long-range bomber and strike aircraft era started with the Tupolev Tu-4 *Bull*, introduced in 1947, followed in the 1950s by the Myasischev M-4 *Bison*, the Tupolev Tu-16 *Badger* and the TU-95 *Bear*. The *M-4 Bison* has been somewhat overlooked, much because of the failed performance for filling its original role as a long-range strategic bomber. The early *Bison A* aircraft from early 1950s simply did not hold the range capabilities needed. The *Bison B* and the specialised *Bison C* with their large search radar for *maritime reconnaissance* and some for Electronic Intelligence (ELINT) operations were all important for

the naval operations.[116] The fact that the aircraft design was not suited for carrying large missiles – still made this an expensive aircraft to keep up for only reconnaissance and tanker roles.

The *TU-16 Badger* was first flown in 1952, and entered service with the strategic aviation forces by 1955.[117] Within few years most of the aircraft were fitted with flight-refuelling equipment. In the 1960s, after the rocket troops taking on the strategic strike role, the aircraft were steadily transferred to the expanding navy.[118] The Badgers became the first missile carrying aircraft for the Navy. The first missile variant, the *Badger B*, was first equipped the 80km range AS-1 *Kennel*[119] anti-ship missile and soon the more advanced anti-ship and land-attack missile AS-5 *Kelt*[120]. The *Badger C* production line came at about the same time – and with the AS-2 *Kipper*[121] missile for anti-ship and land-attack and its large radar installation, it was a true potential. These first cruise missiles had began development in the early 1950s, and was from the start intended as radar-guided anti-ship missiles.[122] The *Badger D* was equipped with the same radar and electronic surveillance capabilities and specialised for maritime reconnaissance. The *Badgers E* through *L* designations was for various roles including reconnaissance, intelligence and jamming. Some Badger (TU-16Z) aircraft were also converted to air-air refuelling for keeping up with the TU-22s with refuelling capability.

The Sovict air power reach in maritime operations and along the flanks became a serious threat with the introduction of the great TU-95 *Bear* aircraft. Still in 1981 Sweetman wrote: "unquestionable the most spectacular of contemporary warplanes".[123] Prototypes flew in early 1950s, and by 1956 the aircraft was operational. For the next 10 years 49 *Bear A* were produced

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[115] J.Sokolovskiy, *Soviet Military Strategy*, p.300.
[116] B.Sweetman, *Soviet Military Aircraft* (California: Presidio Press, 1981), p.140-141.
[117] Dalnaya Aviatzia (DA), Soviet Strategic Aviation.
[118] Aviatsiya Voenno-Morskovo Flota (AVMF), Soviet Naval Aviation.
[119] KS-1 missile - NATO designation: AS-1 Kennel.
[120] KSR-2 missile - NATO designation: AS-5(A) Kelt. The AS-5 had a range of 230km, and was operational by 1961.
[121] K-10S missile - NATO designation: AS-2 Kipper. The missile had appx 250km range.
[122] T.Kadyshev in P.Podvig ed, *Russian Strategic Nuclear Forces*, p.344.
[123] B.Sweetman, *Soviet Military Aircraft*, p.182.

for the classical bomber role and soon reconfigured to carry nuclear bombs, and further 71 missile carrying *Bear B* and 23 *Bear C* for strike were produced and operational by 1959.[124] The *Bear D,* operational by 1964-66, had a long-range maritime reconnaissance and targeting role and mid-course guidance for the long-range surface-to-surface as well as air-to-surface missile systems.[125] The Bear D was equipped with the powerful Big Bulge radar and a secure communication link. The Bear D was renamed TU-142 during the 1960s, indicating that it was a genuine maritime aircraft.

The *TU-22* series, where the initial production line aircraft were named *Blinders,* was projected in the mid 1950s. It was to give a supersonic penetration capability to the existing concept of the TU-16 Badger. The effectiveness of western air defences with high altitude SAMs and radar controlled supersonic interceptors required greater performance of the strategic bombers. But, by the time the aircraft was fully operational, the Soviet greater strategies had moved on to rely on strategic missile systems rather than aircraft. The radical doctrine change of the Soviet Union[126] in the early 1960s had assigned the land-based strategic ballistic missiles in the principle role of strategic strike and deterrence. Many of the first TU-22s (as well as other types) were consequently transferred from the strategic aviation forces to naval aviation for precision maritime strike and for strike in the European regions along the flanks. These TU-22s were named *Blinder B.*[127] The *Blinder C* became an important ELINT aircraft for maritime reconnaissance. These latter B and C batches were not accepted as fully operational till after 1967.

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[124] P.Butowski, *Combat Aircraft*, European Ed, Vol.4, No6 (UK: AIRtime Publishing Inc, May 2003), p.548.
[125] M.Gething, *Sky Guardians, British Air defences 1918-1993*, p.120-121.
[126] After the "secret speech" of Khrushchev in 1956, in which he denounced the cult of personality – is viewed as a turning point in Soviet military thought. In the period 1958-60 the theorists of the High Command agreed that the military doctrine needed revision. At the IV session of the Supreme Soviet of the USSR on 14 January 1960 – Khrushchev outlined a new Soviet military doctrine. (By Harriet Scott's editors' introduction of Sokolovskiy's *Military Strategy*).
[127] The Blinder B's were armed with the AS-4 Kitchen missile, where the naval strike version were capable of a 320km air-to-surface range. (B.Sweetman, *Soviet Military Aircraft*, p.169.) It is reported to have a range exceeding 700km in other sources.

Another interesting aspect of the Soviet long-range reach air power was the development of the long-range and long-endurance fighter Yak-25P of 1953, later replaced by Yak-28Ps in 1960. In addition to the Tu-126 "Moss" AEW and the Tu-128 interceptors this gave the Soviet Union a great reach in the northern areas. These were designed as interceptors and to deny the airspace to western aircraft out to far greater distances that normally lay to land-based fighter aircraft.[128] The Soviet long-range air power strike capabilities were immense, and clearly posed a great threat to British and NATO maritime forces and communication.

The Soviet surface forces

The Naval War Manual of 1957/61 stated that the Soviet surface forces did not constitute a decisive threat to British and NATO forces.[129] This has been discussed in the previous chapter on the Soviet Union as a threat to Great Britain.

Still, it is a reckoned fact that the Soviet surface fleet saw a great build-up during the 1960s. The building of the Sverdlov class got especially great attention. NATO and Britain included, made aircraft and tactics to counter this. This is later covered in the chapter on British ASuW.

To counter NATO anti-surface warfare aircraft, the Sverdlov had the Big-Net radar of some 120nm range on medium bombers. This radar was first seen on an Sverdlov in 1957.[130] The Sverdlovs were the main ships used for the air defence role. The rest of the major warships used mainly the Knife-Rest radar of some 90-110 nm ranges on bombers.

The northern flank of Europe – Norway and the Norwegian Sea

The NATO strategy of Flexible Response had crucial implications for the flanks of Europe and Maritime Air Power. The maritime flanks were the least densely defended areas and the most in need of immediate Allied reinforcement.

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[128] Note: Soviet fighter aircraft were not equipped with in-flight refueling systems until 1979 with the Mig-31. (I.Sutyagin and P.Podvig, *Russian Strategic Nuclear Forces*, p.410.)
[129] Naval War Manual (1957/1961), p.87.
[130] ADM 239/546, Soviet aerials of naval interest (declassified SECRET).

Land forces were important at the flanks, both for stopping any attempt of land invasion and for protection of air and naval bases. The combat aircraft had a prime role of intercepting the large formations of Soviet long-range bombers and missile attack aircraft, as well as protection of airbases, land and maritime forces in these theatres. They got more and more focused on this interception role during the late 1960s and the 1970s due to the increasing range of Soviet anti-ship missiles. In this era, the Soviet fleet of submarines was assessed to be the greatest threat to the naval surface forces. In addition the immense threat of the strategic submarines became a reality. For this reasons a large portion of the western naval vessels were designed and designated as ASW platforms. SLOC-operations for both sea and air power became a buzzword – well know for all military.

Maritime forces – naval vessels, organic and land-based air power became important both for anti-invasion and sea control. The maritime threat constituted Soviet long-range aircraft, surface ships and submarines, especially on Europe's northern flank. From early 1960s, especially after 1963, large Soviet naval exercises were conducted in the North Norwegian waters, even out to the GIUK and around the British Isles.[131] If the Soviet forces were to win the air and land war at this flank of the Norwegian coast, they would be able to move forward their forces of long-range airpower and seriously threaten continental Europe and Britain, as well as cover large portions of the northern Atlantic. The Soviet forces would be able to secure its other maritime forces with air cover, as well as work offensively with their heavy armament of long-range air-to-surface missiles.

This describes the core difference the new strategy of Flexible Response meant for maritime forces and Maritime Air Power. The conventional struggle on land, both in central Europe as well as along the flanks were in the centre of this strategy – and thereby the maritime tasks were to protect the flanks and protect the Sea Lines of Communication for support of the land-war.

The flanks further had a special focus, since they were viewed as the most likely areas of limited Soviet attacks because of the risk of nuclear escalation along the central front.[132]

Specific for British security, and British perspective on the Norwegian waters and northern land-areas, Admiral Sir William Staveley, First Sea Lord (1985-89), explains:

> *Considering the situation if we were to relax our guard in this strategically important area, putting at risk the sparsely populated region of North Norway, then Iceland and the Faeroes and thus placing the North Sea and the United Kingdom so much closer to the front line of Soviet forces, needlessly exposing ourselves to a greater threat which would make warfighting a much more daunting prospect for NATO. Put another way, if we were to permit the Soviet Navy free reign north of the Greenland-Iceland-Norway Gap, their front line would be closer to this country than the inner German border: that is a prospect which I would not relish.* [133]

Staveley at the same time states: "Recognizing the vital importance of the Northern Flank to the conduct of maritime operations in the Norwegian Sea and Atlantic as well to the defence of the United Kingdom itself, we commit substantial resources to the defence of the region".

Northern Norway and the Norwegian Sea were in the centre for these heights of the Cold War – this era of powerful missile carrying nuclear submarines and missile armed long-range aviation. The geographical area was crucial in both the British national and NATO "forward defence" strategy.

The strategy of the Soviet forces in the northern region

Both military and political studies of Soviet strategy in this period have been focused on whether the Soviet naval forces have been defensive and protective – or offensive oriented. Was the main objective for the naval forces to add a layer to the traditional Russian protection of the homeland and later their submarine bastions? Or did the Soviets have aspirations of a greater blue-ocean navy, capable of projecting influence around the world and in the far extreme – finally

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[131] S.Maloney, "Fire Brigade or Tocsin? NATO's ACE Mobile Force, Flexible Response and Cold War" in The Journal of Strategic Studies (Vol.25, nr.4, December 2004), p.590-591 .
[132] J.Sokolsky in J.Hattendorf and R.Jordan ed, *Maritime Strategy and Balance of Power*, p.321.
[133] W.Staveley in G.Till, ed., *British and NATO's Northern Flank* (NY: ST.Martins Press, 1988), p 68.

challenging the Command of the United States on the world ocean? It is important to notice these two argued perspectives of the Soviet naval build up.

The aspirations of the Soviet Navy became high by the end of the1970s. It would be strange if political and military leaders – as well as writers and strategists did not explore this possibility. Still, the navy classically have had a subordinate position to the army in Soviet and Russian thinking, and if you go to sources other than those of naval experts – the homeland, army and the strategic rocket troops do have a more prominent position.

About the perspective of this research, the capabilities and the balance of the Soviet Navy and long-range air force for influence in the Norwegian Sea, and possible strikes on NATOs northern flank were undisputed potentials.

The Soviet Union disputing NATO's control of the Norwegian Sea

By the composition of the Soviet naval and air forces of the 1960s, there were mainly two dominating scenarios for the fight for control of the Norwegian Sea. Namely who would have air superiority in the area – the Soviet Union or NATO? This was in turn dependant on who would be able to seize control over the airfields of Northern Norway.

- If the Soviets would able to capture Northern Norway with its airfields, this would pose a multi-threat upon NATO. With forwarded land based air defences and combat aircraft, the Soviets could pose an air superiority – which in turn would enable their naval surface forces to move southwest. In case of Soviet land based strike air power, it would pose an immense offensive threat to northern continental Europe and Britain. The submarine fleet was for the initial years, all up to the late 1960s, dependant on breaking out of the Barents and closing the naval forces and shorelines to use its limited range missiles.[134]

[134] From late 1960s, the Soviet was able to change the tactics and hold the ballistic missile submarines in safe heavens.

- If NATO could keep control of Northern Norway, they could effectively close off for all Soviet naval surface forces and intercept the strike aircraft, and be able to put great ASW forces in the hunt for the Soviet submarines that were designed to dispute the NATO control of the Norwegian Sea and attack Europe and Britain with missiles.

As for combat between military forces, tactical nuclear weapons were expected to be used against groupings of enemy forces and destruction of rocket sites. This single conviction at the military strategic level of decision-makers in the Soviet Union had crucial impact on the conduct of maritime warfare and its technical development. Sokolovskiy stated about nuclear weapons"...profound changes will take place in the methods of carrying out military operations in naval theatre".[135] Further he specified:

> *In a future war the tasks of destroying shore targets, of defeating grouping of the naval forces of an aggressor, his assault carrier formations and rocket-carrying submarines at bases and on the high seas, disruption of sea and ocean communication, will be accomplished by strikes of rocket troops and mobile operations of rocket-carrying submarines co-operating with rocket-carrying aircraft.*

Sokolovskiy later in his writing stresses that bombers and fighters are more successful at destroying moving targets than are the rocket troops with their ballistic missiles.[136] Here we see some of the background for the Soviet Navy's heavy focus on aircraft in anti-surface role of missions.

As for the British perspective of the time, this is well described in the Naval War Manual of 1957. The threat of nuclear bombardment would be greatest to those forces in harbour. At sea, the threat would constitute submarines, independent and in co-operation with long-range scouting aircraft. In addition to the submarine, the long-range bomber or strike aircraft armed with long-range missiles would be a great threat. About the Soviet surface forces: "Surface

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[135] J.Sokolovskiy *Soviet Military Strategy*, p.203.
[136] J.Sokolovskiy *Soviet Military Strategy*, p.253.

raiders are not likely to be used on any scale, but may possibly be deployed in more remote areas to attack independent shipping and to extend the protection of forces".[137]

Part-conclusion on the Soviet threat

As a *closing* and *thought-provoking* statement on the Soviet "menace" - some words of Sokolovskiy of the High Commands of the Soviet forces may give a complete picture of the roles of the Navy of this era: "Long-range bomber craft, armed with long-range missiles, retain the capacity of delivering independent blows to enemy targets, especially at sea and in the ocean, but also on the coast and in the deep areas of the enemy territory".[138] Further he stated about the balance of the surface, submarine and air platforms:

> *...the Navy will keep such important tasks as combating the enemy's naval forces on the sea and at the bases and also disrupting his ocean and sea transport. These problems can be solved most effectively by submarines and planes armed with nuclear rocket weapons and torpedoes. A certain number of surface ships are also necessary to safeguard the activities of submarines and to perform secondary missions such as protection of naval communication lanes and co-ordination with Ground Troops in operations carried out in coastal regions.*

Specific for naval aviation he said: "Naval aviation must be able to attack warships at sea at distances at which they will not be able to use their aircraft carrier forces and missiles for attacking targets in the socialist countries." Further: "... naval aviation will be called upon to destroy enemy transport at sea and at their bases."

I will conclude that fighting the Soviet submarines and the long-range bombers and missile carrying strike aircraft primarily, and secondary the Soviet surface navy were the dimensioning threats. Consequently, the British and NATO forces of Northern Europe had to be dimensioned for establishing control over Northern Norway and the Norwegian Sea.

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[137] Naval War Manual (1957/1961), p.87.
[138] J.Sokolovskiy, *Soviet Military Strategy*, p. 254.

British Maritime Air Power – the Maritime Objectives

Radical changes to British defence policy

The Sandy's radical defence White Paper of 1957 is reckoned to be one of the greatest turning points in British foreign and defence policy in modern times. The post-war years after the Second World War and up to this point had been coloured by three distinct factors. British colonies, which remained as much responsibility as assets, the advent of nuclear weapons – and the sad fact that Britain was effectively bankrupt.[139]

The ambitions of upholding its international position did not reflect the economic state of the country. The great changes to British defence policy and Grand Strategy[140] occurred in the period from 1957 to 1967, by when the East of Suez had ended, nuclear strategies had matured to Flexible Response and the great carrier era of RN had ended.

These changes are well described by the official defence reviews, as well as thoroughly discussed by historians as Grove, Hampshire and Dockrill. The Cold War produced four major policy changes of military affairs, which could be broadly classified as defence reviews. The first in 1957 under Duncan Sandys, which ended up in Cmnd.124 "Defence Outline of Future Policy". The second came in the mid-sixties under Dennis Healey. This was a review which went on for some 2-3 years, ending up as the Cmnd.2901 "The Defence Review" in 1966, and later a part two by 1967 – even followed by a White Paper in 1968.[141]

The defence policy and the strategy of Britain in the Cold War era of Massive Retaliation was influenced by the three above mentioned main factors. First, one tried to cling on to the colonial status throughout the period. Secondly, the state of Britain's economy did not improve and defence expenditure was far too high. An expenditure of more than 10 per cent of the total

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[139] E.J.Grove, *Vanguard to Trident*, p.2-4.
[140] The British Naval War Manuals defined the levels of strategy as: Grand, Major and Theatre Strategy during the early Cold War era.
[141] Later there were two major reviews after the period of this dissertation: One in 1975-76 under Roy Mason, followed by one in 1981 under John Nott.

national budget was the reality. Thirdly, the galloping evolution of nuclear weapons and a true belief that they would be used in a great conflict became increasingly important.

In addition to these factors, the Sandys review can be traced back to the Suez debacle of the previous year, which had been a diplomatic disaster for the first, and in addition had revealed a poor state of readiness of British Forces and obsolescence of much of their equipment. In this sense, the Suez crisis of 1956 was a turning point for British involvement in its former colonies. The Anglo-French invasion of Egypt may be labelled the "start of the end" to British colonial military presence. The review was conducted over a very short period – only two months – and placed the priorities on nuclear deterrence and missiles. Many overseas garrisons were to be reduced, replaced to an extent by aircraft carriers. Following, the Royal Navy would require a balanced fleet in the Far East. The air and army forces were to get a greater focus on Europe and NATO – on behalf of the eastern areas. The Sandys review included a focus on the conventional army, air and naval forces at home to concentrate on protection of the nuclear forces. The review concluded that there at present were no means of providing adequate protection against a nuclear attack. The fighter aircraft of the RAF could take on a large number of the enemy bomber, but a proportion would get through. Following, the peace largely was assessed to rely upon nuclear retaliation. The Sandys review following set out the priorities for the RAF, as well as the army: the protection of the British bomber airfields. A manned fighter force was required to maintain this role, but was in due course to be replaced by ground-air missile systems. Following, the nuclear deterrent strategy became the prime focus of British forces, first with the V-bombers – later with the Navy's Polaris. For the period late 1950s till the Polaris was operational and presented a second strike capability – this was a questionable strategy. The Soviet advance in missile technology by this time had effectively reduced the warning-time down to 15 minutes and made the V-bomber bases hard and easy targets. British reaction time was not adequate, both

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http://www.parliament.the-stationery-office.co.uk/pa/cm199798/cmdfence/138/13804.htm , June 2004.

operational by the Bomber Command – and not at least due to the Command and Control regime of the nuclear deterrent.[142] Still, this was the strategy of the time – and it made rationale for the balancing of the rest of the British armed forces.

As for the operational rationale the 1957 review rested upon, it was based on the work of a group under Norman Brook, the Cabinet Secretary. They made a report on Britain's position in world affairs of 1956. They concluded that the Soviet Union and China were unlikely to resort to aggression, and that the large conventional forces were not necessary. This report was submitted to a ministerial Policy Review Committee for defence review, and is reckoned to have made much of the rationale behind the radical White Paper of Sandys'.[143]

The Sandys review, with its pressure to reduce the forces, led to many inter-service conflicts. One looked at reducing the FAA and use RAF pilots on the carriers, and on the other side there was talk of handing Coastal Command over to the Navy. From the Navy perspective, RAF aircrew would not have the naval mind and understanding. On the contrary, the RAF argued that the RAF crew would bring its own and true air power understanding and experience to the Navy.[144] No great changes came about, as the RAF responsibility was to remain, the FAA was to remain with the Navy and RAF was to keep responsibility of Coastal Command.[145] Still, at the higher levels of the military and political level, it was a troublesome period.

The next five years plan; following Sandys review of 1957, came in 1962. The continuing basic objectives of British defence policy according to the 1962 five-year plan were:[146]

- *To maintain the security of this country.*
- *To carry out our obligations for the protection of British territories overseas and those to whom we owe a special duty by treaty or otherwise.*

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[142] S.Twigge and L.Scott, "Learning to Love the Bomb: The Command and Control of British Nuclear Forces, 1953-1964" in The Journal of Strategic Studies (Vol.22, nr.1, March 1999), p.49.
[143] S.J.Ball, *The bomber in British strategy* (Oxford: Westview Press, 1995), p.144.
[144] AIR 41/86, The Raf in Post War Years: Defence Policy and the RAF, 1956-1963 (declassified SECRET), p.173-174.
[145] ADM 335/56, Defence plans: air defence; Committee on Rationalisation of Air Power (declassified SECRET).
[146] Cmnd.1639, Statement on Defence, 1962, The Next Five Years.

- *To make our contribution to the defence of the free world and the prevention of war in accordance with the arrangements we have with individual countries and under collective security treaties.*

Even though the concept of Flexible Response was not yet adopted, the British as well as the Americans had started to get a more sceptical view on the pure deterrent of Massive Retaliation. Compared to the Sandys review, with its strong emphasis of the nuclear deterrent forces, the main position in this 1962 White Paper was that conventional forces had to be kept for preventing tension to break into a major conflict, but that NATO had to keep credible nuclear forces to deter any potential aggressors. The 1962 White Paper said:

> *The Government do not believe that the defence of Europe could be left to long-range nuclear weapons alone, nor that its fate could be decided by long drawn out fighting limited to conventional forces. The government wish to ensure that NATO forces are balanced and NATO strategy flexible.*[147]

The nuclear deterrent was to be upheld in line of Sandys' review, but the 1962 White Paper wanted to compliment it by necessary conventional forces. This period was coloured by a political discussion on forces for the European theatre or for "out-of NATO area" forces. All the governments of this era remained a focus on the colonial interests over those of the European areas. The blocking of Britain's accession to the European Common Marked (EEC) by general de Gaulle in 1963 just undermined this focus across the political landscape.[148] The realities for the military force came to be a two-folded mission of both out-of NATO area and homeland and European defence and deterrent forces. The British deterrent was to be maintained throughout the 1960s by the V-bombers fitted with standoff weapons, Blue Steel in the first instance and later the Skybolt.[149] For the Navy, the 1962 White Paper laid down that the Fleet should be a balanced one, under the sea, on the surface and in the air – because the British security rested upon the ability to assure free movement by sea. The paper further listed all the capabilities and

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[147] Cmnd.1639, Statement on Defence, 1962, The Next Five Years.
[148] M.Middeke, "Britain's global Military Role, Conventional Defence and Anglo-American Interdependence after Nassau" in The Journal of Strategic Studies, (Vol.24,nr.1, March 2001), p.143-146.

the new platform and weapons coming. This balanced force would have focus on the mobility of sea borne power with amphibious capability and air power. In addition effective anti-submarine forces were still required.

This White Paper of 1962 also looked ahead regarding the carrier fleet, and reckoned it difficult to forecast the requirements of such ships in the future. Still, clearly it had to be designed primarily for amphibious and land operations. The roles of amphibious warfare and anti-submarine warfare were the priorities. The Admiralty had to fight on the defensive for its large general-purpose carriers already from the early 1960s. In way, this also came to be argued extensively from 1963 onward as part of the out-of NATO area or European focus. The Admiralty argued that new general purpose carriers could do both, and in fact take over the entire role of deterring limited wars and aggression in the east of Suez area.

The following White Papers of the later half of the 1960s did not have any immediate effect for the forces of the period of this dissertation, but do indicate the political trends and focus of the period.

The Healey review went on from 1965 to 1968. In essence it was a series of separate studies. The initial report to the Parliament came as a White Paper in 1966. Focus was even more put on the economical realities. The economic expenditures were still too high for defence. They had managed to get it down from more than 10 per cent of the Gross National Product in the 1950s to about 7 per cent by 1966; the aim was to get down to a stable level of 6 per cent.[150]

This famous White Paper first of all is known for its cancellation of the Admiralty's great CVA-01. The paper discusses the future of the carrier force in some detail, but the core argument was that a carrier of this magnitude would occupy far too much of the resources. The first supporting argument of the decision was "...only one type of operation exists for which carriers and carrier-

[149] Skybolt was later cancelled. Details on the weapon systems come later in the dissertation.
[150] Cmnd.2901, Statement on the Defence Estimates 1966, part I: The Defence Review, Feb 1966.

borne aircraft would be indispensable: that is for landing, or withdrawal, of troops against sophisticated opposition outside the range of land based cover". The second supporting argument was that the future bomber, first the TSR-2, later the FB-111, would take on the capabilities of the expensive carriers and that future operations would be in conjunction with other allied forces. Future land-based aircraft would take on also all the strike-reconnaissance and air defence functions of the carrier aircraft. It is an interesting fact that only ten years earlier the Sandys review had proposed that the overseas garrisons should be replaced to an extent by aircraft carriers. It is also interesting to notice that all these were cancelled due to the economical realities of the 1960s, which culminated in 1967.

The last part of the Healey reviews was not completed until mid-1967. The process did involve a review of foreign commitments, but that followed after the decisions to make substantial savings by cancelling major equipment orders and reductions of the Army. The economic problems had accumulated and a very hasty retreat from the former colonies and foreign bases soon became a reality. Throughout the sixties these issues of economy, the Far East and nuclear strategies stayed central in discussion on British policy. Both the Conservative and Labour governments of the period thought that Britain had an important role to play for international peace and security in the Middle East and in the Far East. The politicians were pressed between the economic realities and the pressure to keep up with all the traditional tasks and assignments. It is well described by Dockrill:

"... Harold Wilson's Labour government after 1964 attempted to hold down defence expenditure and at the same time cling on to Britain's role east of Suez. Wilson's effort to square the circle came to grief in 1967-8 when a succession of serious financial and economic crisis forced the government to abandon its role east of Suez and concentrate its defence efforts on the West European theatre".[151]

[151] M.Dockrill, *British Defence since 1945* (Oxford, UK: Basil Blackwell, 1988), p.82.

The supplementary Defence White Paper on 18 July 1967 represented the Wilson government's first true admission that financial and political realities " ...had made the sacrifice of the major part of Britain's responsibilities East of Suez inevitable".[152] The following 1968 defence White Paper, in an attempt to stay within a £2 billion cash limit, proposed accelerated withdrawal from Singapore and Malaysia as well as from the Persian Gulf (all to be completed by 1971). The East of Suez withdrawal was to become a reality.

Several events marked the following hasty retreat from the British role East of Suez. After the end of the confrontation between Malaysia and Indonesia in 1967, 10.000 British servicemen were withdrawn from Borneo. There were great discussions and criticism of the British role in the area after the crisis of Rhodesia (declaring independence in 1965) and Britain's inability to persuade Israel to give up her conquests after the 1967 Arab-Israeli War. Finally, Britain did not commit herself to defend South Arabia after her independence in 1968.

One may say that the national strategy finally was adopting the realities of the financial basis of Britain. From the late1960s we witness a new strategy – based on more commitment to continental Europe and areas closer to the British Isles and on maritime nuclear deterrent, as well as balanced conventional forces. Britain only upheld a few of its garrisons around the world, and Britain had then transited from a global power to a regional power.

The Maritime Objectives

The British maritime objectives were diffuse in this period going into the nuclear age and era of Massive Retaliation. As described by Sandys' White Paper:[153]

> *The role of naval forces in total war is somewhat uncertain. It may well be that the initial nuclear bombardment and counter-bombardment by aircraft or rockets would be so crippling as to bring the war to an end within a few weeks or even days, in which case naval operations would not play any significant part.*
>
> *...On the other hand, there is the possibility that the nuclear battle might not prove immediate decisive; and in that event it would be of great importance to defend Atlantic*

[152] M.Dockrill, *British Defence since 1945*, p.94-95.
[153] Cmnd.124, Defence Outline of Future Policy, 1957.

communication against submarine attack. It is therefore necessary for NATO to maintain substantial naval forces and maritime air units.

While this was the case of global war with the Soviet Union, the RN's peacetime roles still would have an important position. According to the Sandys review, the carrier force was intended to take over some of the responsibility of the abandoned garrisons in the eastward areas. While the nuclear strategy made reason for downscaling of the conventional forces, and was viewed neccssary to hold on to a position among the greater influential military power – it had no or very little relevance to the low-level conflicts and crisis that Britain classically was engaged in around the world. The British maritime objectives of the era of Massive Retaliation may from the 1957 defence outline be summed up as follows:

- Protection of Atlantic communication against a submarine threat. Which would require great air and surface ASW forces to be prioritised.
- General peacetime roles, especially in the Far East. Which in fact would require a more classically balanced task force. In addition, the review stated the carrier as a mobile air station as the core naval capability, and other surface forces were for support.

As for the maritime objectives for FAA naval aviation in the home-region, Sandys had previously noted three main objectives during a ministerial meeting in 1956.[154] First the defence of Norway, secondly offensive operations in the Baltic Sea and North Sea and mine-laying in enemy waters and finally the protection of Atlantic convoys against Soviet raiders. He went on by saying that these tasks could well be managed by land based air power and US carrier support. He was not in favour of spending too much on the carrier fleet.

About the protection of the Atlantic convoys, there were two broad possibilities discussed.[155] If nuclear war was to prove decisive, there was no need for great forces for this task. On the other

[154] E.J.Grove, *Vanguard to Trident,* p.102.
[155] AIR 41/86, p.50.

hand, if nuclear war did not prove decisive, communication had to be protected, mainly against the submarine threat but also against the air strikes. The latter alternative became the agreed perspective.

Even though there were great discussions on the impact of nuclear weapons on maritime warfare, the Admiralty with their naval doctrine pointed out four fundamental aims of British Maritime Strategy to support the grand strategy of the country.[156] The doctrine acknowledged the uncertainty of future war – but argued that these fundamental aims were necessary to uphold.

- To defend the United Kingdom from attack.
- To defeat all enemy attempts to interrupt merchant shipping plying between the United Kingdom and countries from which essential supplies are obtained.
- To prevent the enemy from using merchant ships.
- To launch attacks from the sea on enemy and enemy-held territory.

These fundamental aims listed by the naval doctrine of the era required balanced forces, but at the same time the Soviet submarine and long-range aircraft had been identified as the main threat. As for the colonial tasks, this also required a balanced force capable of a variety of tasks, all from embargo to amphibious operations.

The next chapter will discuss the variety of roles in a tactical and technological perspective to examine whether Britain was able to fulfil the maritime objectives set forth.

[156] Naval War Manual (1957/1961), p.61.

British Maritime Air Power– the core capabilities and roles

This main chapter applies the theoretical framework of core capabilities and roles of Maritime Air Power to the British Maritime Air Power assets which were front-line operational during the time frame 1957 – 1967. The British forces will be described as of their tactical and technical capacities, for then to be discussed in relation to the Soviet threats of the northern maritime region previously discussed, as well as the strategic and doctrinal objectives of the era.

Information Exploitation

British aircraft and systems

Information collection by continues surveillance and tactical reconnaissance – followed by effective management of the data is essential for all military actions. Various British aircraft were used for this purpose of information collection on potentially hostile forces operating below, at or above the ocean surface. Some aircraft, often fighter type of aircraft, were focused on tactical reconnaissance of enemy forces, some for long endurance general surveillance - while others are more specialised for collection of electronic, communication and acoustic signatures of the enemy.[157]

As for the role of continues maritime surveillance, the long range and endurance aircraft were the main assets. With the emerging Cold War, the British had to take their share of the surveillance of the Soviet naval forces that moved out of their home areas of the Barents Sea. The RAF was in a bad (or maybe lucky) position when all the Second World War long-range patrol aircraft ended their lend-lease periods with the Americans. The B-17 Flying fortress, B-24 Liberators and Catalina flying-boats were returned or scrapped, and by 1946 Coastal Command was reduced to two squadrons of Sunderland flying-boats, four general reconnaissance

[157] These latter aircraft intelligence communities are normally very "closed" – and only open up on a need-to-know basis. This is a great concern for historians, were even the normal 30-year rule do not apply for releasing state and military information.

squadrons of Lancasters and Halifaxes, plus two squadrons of medium-range strike aircraft.[158] Then finally the Shackleton was introduced in the early 1950s as the future patrol aircraft for surveillance and long-range reconnaissance. These were initially labelled GR for General Reconnaissance[159], but soon labelled MR for Maritime Reconnaissance by 1952. The newly arrived 120 Squadron and the 217 Squadron at Kinloss Air Station were the first to put them into service in 1951. They gradually replaced all the P2 Neptune aircraft, which were on interim-leas from the United States, and the old Avro Lancasters. The Shackleton was the first aircraft built especially for Coastal Command. The aircraft had a reasonable good surface search radar by 1950s standard, with all-around coverage from the Mk.2 batch on, as well as ESM equipment and active and passive sonobuoy systems. The greatest attribute of the Shackleton was its range and endurance capabilities. On one occasion one of the aircraft reached a point 300 miles off New York to meet a cruiser carrying Sir Winston Churchill – before returning.[160] Still, the Shackleton was already late in the 1950s obsolete in several aspects. As for the role of surveillance and reconnaissance, the range and endurance was a great attribute – but the AVS-21 radar system had poor performance. The ASV-21 radar had detection range of about 40nm on fisher trawlers and smaller naval vessels.[161] The Shackletons were the main asset for surface surveillance, but they often worked close with other forces.

The V-force of Bomber Command is not often mentioned in case of maritime warfare, but contributed to maritime surveillance and reconnaissance roles (as well as in the strike role). The Victor PR aircraft had a good surface radar with ranges out to 100nm detection-range on naval ships. These speed and sensor attributes of the Victors, added to the speed and radar limitations of the Shackleton – made the rationale behind Victor-Shackleton co-operation for surveillance

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[158] D.Cook, "50th Anniversary of Shackleton's First Flight" in *Maritime Patrol Aviation*, June 2000.
[159] M.Gething, *Sky Guardians, British Air defences 1918-1993* (London: Arms and Armour Press, 1993), p.140.
[160] http://www.kinloss-raf.co.uk/shackleton.html , Feb 2004.
[161] In a high-density (many vessels) area, the 36nm range-scale would be used. AIR 15/927, Optimum search tactics for the detection of ELINT (AGI) vessels within the fishing fleet (declassified SECRET).

and reconnaissance of the Norwegian Sea.[162] Three Victors were to fly racetracks at optimum radar-coverage height and report the surface picture to the six Shackletons there would stay at low level and identify all the contacts reported. These were time-consuming operations. Up to 150 ships could be within a radius of only 30nm in the Norwegian Sea, and all ships had to be positively identified. Reconnaissance of the British waters and the Norwegian Sea was a prioritised role of Coastal Command, especially for identifying the large numbers of Soviet intelligence ships. These could be small naval-like ships, or very often trawlers (fishing boats) and merchant ships with intelligence equipment.[163] In the first half of the 1960s there were increasing numbers of merchant, fishery and research ships which offensively closed British and NATO ports and naval operating areas.[164]

[162] AIR 15/923, Evaluation of the Victor/Shackleton co-operation technique for surveillance of the Norwegian Sea (declassified SECRET).
[163] AIR 15/927.
[164] ADM 1/28642, Control of Soviet vessels in British territorial waters (declassified SECRET).

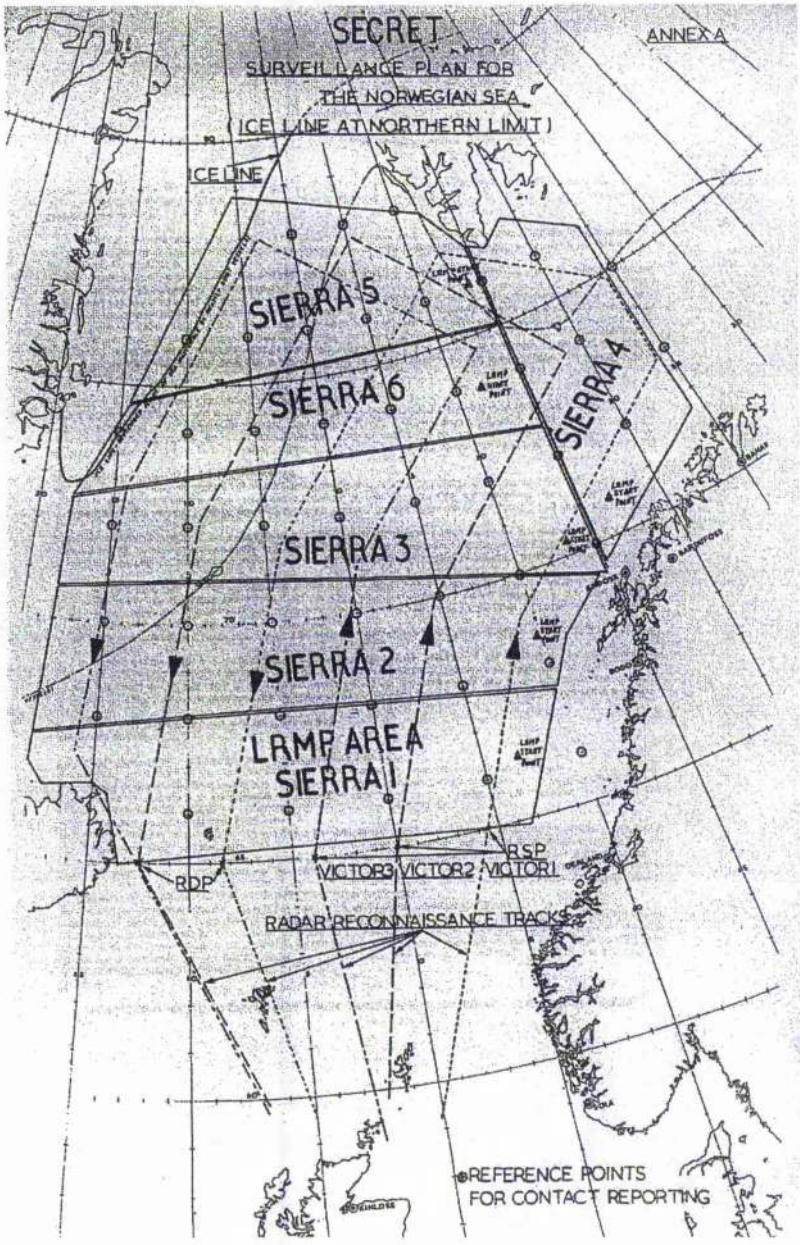

Figure 3: Victor and Shackleton combined operations for maritime surveillance and reconnaissance (AIR 15/923 (declassified SECRET)).

The *intelligence gatherings* of electronic and communication signal types were during the Cold War often referred to as "Radio Proving Flights". The main purpose was to build a picture of the Soviet Air Defences, where they were positioned, as well as how well they functioned and operated. In addition were the specialised collectors able to record all signal data of aircraft, land

and sea based surveillance-radars and surface-to-air missile systems (SAM) – this to be able to program own ESM, ECM[165] and jammer systems of NATO aircraft and ships.

The RAF started the post-war era of signal intelligence with the Lincoln B2 and the Washington RB-29. For the 1950-70s, the RAF operated Canberra B.2 (1958-59) and B.6's (1958-76), the Comet R Mk.2 (1958-75), as well as the Hastings C.1 (1963-67) aircraft in the electronic intelligence role for all the military services.[166] It was the 192 Squadron, later renamed the 51 Squadron which constituted the main air intelligence community for the British armed forces, both over land and sea. The focus area for the 1950s and 60s were the Barents Sea, the Baltic, the Black Sea and the Soviet-Iranian border.[167]

As for the special electronic intercept flights on Soviet naval forces, these were labelled "Operation Grape".[168] They were often linked to shadowing operations called operation "Mozelle"[169] or "Garnett". For electronic search operations, these were labelled operation "Claret" or "Chianti" in the Mediterranean. All these special intelligence operations were in the maritime theatre and on maritime targets, but mainly done by RAF Bomber Command No.90 Group.[170] The FAA also operated electronic warfare aircraft under the 831 Squadron. The Squadron operated in this timeframe the Sea Venom Mk.22 ECM and some Gannet Mk.6 ECM aircraft.[171]

Photorecconnaissance (PR) was a very important role all from the Second World War on with the Mosquito and Spitfire. During the 1950s and 60s most FAA and long range RAF strike aircraft were used in this role. There was even PR Victor aircraft made as earlier mentioned. The

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[165] ESM: electronic support measures / ECM: electronic counter measures. In the period of early Cold War, the terminology "passive ECM" was used for what we contemporary label "ESM".
[166] C.Jefford, *RAF Squadrons* (Shrewsbury: Airlife, 2001), p.44.
[167] http://spyflight.co.uk/RADIO.HTM , March 2004.
[168] ADM 1/29320, Operation GRAPE: blanket approval for electronic intercepts in the vicinity of Soviet Naval forces on the high seas (declassified TOP SECRET).
[169] "Mozelle" was sought to be co-ordinated with Norwegian, Dutch, French and American effort (ADM 1/29320).
[170] ADM 1/29320.
[171] B.Gunston and D.Donald, "Fleet Air Arm 1960-69" in *Wings of fame* (Vol.1, 1995), p.196.

Canberra PR3 was perhaps the most specialised and best known for the role. It was operational by March 1950.[172] The PR3 was later relieved by the PR7 and PR9, of which more than one hundred were built by 1958. The PR Canberra's had both strategic and tactical roles of both land and maritime areas. The specialised maritime photoreconnaissance operations were labelled "Sherry" or "Rury".[173] Aircraft in this role had to be relatively fast and the flights were extremely high risk both for the aircrew and for the sake of political tensions. The RAF conducted several flights deep into Soviet territory from the early 1950s.[174] By then space surveillance systems gradually became more important for photoreconnaissance over land areas, though aircraft still were important supplements. In case of Maritime Air Power, photoreconnaissance continued to be important – and still is very much so today. The purposes of the photographic reconnaissance of naval forces are to get the latest information of equipment and placement, as well as recognition.

Another important aspect of maritime surveillance and intelligence is also the collection of acoustic information. This became very important from the 1950s onward, by when the SOSUS systems had become operational.

All long-range surveillance systems – both electronical surveillance from space there became operational by the 1970s and acoustic surveillance by the SOSUS, were crucially dependent on good recognition data that have been positively matched to the true source by e.g. friendly aircraft and submarines. For the acoustic collection, the British only had the *Shackletons* and with them poor collection-capability on acoustics. The Shackletons were equipped with a 16 channel sonic system. The system could display two sonobuoys, active or passive,

[172] D.Aart, *Aerial Espionage* (Shrewsbury: Airlife, 1985), p.18-19.
[173] ADM 1/29320.
[174] http://www.charter88.org.uk/pubs/violations/lashmar.html , March 2004.

simultaneously. This was not a LOFAR[175] system, but a system that looked for cavitation noise of the propellers.[176]

The Shackletons were the backbone of Costal Commands surveillance and long-range reconnaissance capability through the 1950s and 1960s. Still, it was by aircraft design an old aircraft from the beginning. Technical problems haunted it - and by the early 1960s the need to find a modern replacement was introduced. This must be seen in relation to the introduction of the P3 Orion, which came about in the late 1950s – and had sat new standards to long-range maritime patrol aircraft. There were basically four aircraft evaluated as the Shackleton replacement: The modern P3 Orion and Dassult Atlantic – as well as two British designs based on commercial aircraft. There are some interesting notes from the project in DEFE 25/15.[177] A note stated about the Orion: "… cheapest, but politically impossible to buy American", and went on about the Dassult Atlantic: "… Air Force Departments preference and cheapest after Orion, but politically difficult to buy French". It was agreed by Ministers to go for a Comet variant by 1965.[178]

The jet aircraft Nimrod, based on the Comet, finally released the Shackletons in the period 1969-71 for the traditional MR roles.

The first military surveillance and reconnaissance *satellites* were introduced though in the early 1960s. The Soviets' first and second-generation photoreconnaissance satellites were launched in 1962-3, based on the Vostok and Soyuz launch platforms. Soviet satellite technology developed rapidly, and the systems were joined by a third generation in 1968. These non-manoeuvrable and low-resolution satellites continued regular operations until 1985.[179] At the same time, from early

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[175] LOw Frequency Analysis and Recording. Operational by the late 1950s, but the British ASW forces did not have a LOFAR system before the introduction of the Nimrod in 1969.
[176] Air Publication 2552P vol.1, March 1963, "Sonobuoy Transmitter Type T.7725".
[177] DEFE 25/15, Shackleton replacement (declassified TOP SECRET).
[178] DEFE 25/15, Minute Ref. SZ/278/65.
[179] http://www.anu.edu.au/english/jems/lb/majorwriting/Thesis/chapter3.html , April 2004.

1960s, the concepts of anti-satellite systems were developed.[180] The first operational system of satellite tracking radars and anti-satellite missiles was due by 1967, and fully operational by 1970. Still, the satellite systems intended for the maritime theatre was not operational till the mid-1970s.[181]

The air surveillance and early warning roles are further important capabilities for information exploitation of a balanced military force. These systems have been both *ground-based* and *ship-based*, and even elevated by aircraft.

Ground based early warning and control:

After the Second World War the famous British radar system were run down. A new major conflict was not foreseen for the next decade. The soon developments of the Cold War, and specifically the Soviet nuclear test in 1949 and the Korean War made the grounding of new modern air defences and early warning system to accelerate. Already in 1949 an overhaul and improvement program named Rotor was introduced. Research and procurement led to a new centrimetic early warning radar codenamed Green Garlic, later known as Type-80, to take place of the Chain Home. The Type-80 came about in 1953, and was later supplemented by the Type-7 and 11 Ground Control Interceptor (GCI) sets and the Type-13 and 14 for low altitude coverage. The problem of the ground based air defences from late 1950s onward was to detect the high-speed bombers armed with standoff missiles in time to launch and intercept with own aircraft. The whole process from detection to control of aircraft for interception had to be as rapid and efficient as possible. Due to this, the Type-80 facilities in reality often took on all the roles of the other radar types and the huge command and control centres. A system of master radar stations

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[180] I.Sutyagin and P.Podvig, *Russian Strategic Nuclear Forces*, p.434-435.

[181] In case of ocean surveillance and reconnaissance by satellites – it was first conducted by radar or electronic measures, and soon also complimented by electro-optical and infrared means. Today features as SAR (Synthetic Aperture Radar) systems are operational across the spectrum.
The first satellites in maritime surveillance and reconnaissance became an operational reality by 1974, when the Soviet Union launched their first RORSATs (Radar Ocean Reconnaissance Satellites). The US launched their first

was developed around the Type-80. In 1959 a project called the "Plan Ahead", later re-named "Linesman" by 1961, was set out to replace the multiplicity of smaller sites by three massive sites. The first of the new high power radars (Type-84) of this system was handed over to the RAF in 1962 for testing, but the Lineman system was not an official operational part of the RAF till 1973. Another interesting project, which started in the early 1960s, was the discussions on a NATO air defence project called NADGE (NATO Air Defence Ground Environment), which have had a central position from the 1970s till present.

Ground based early warning and radar control have since the 1950s had ranges of more than 200 miles on the larger bomber and strike aircraft, and consequently been part of the national maritime areas.

Ship based early warning and control:

British Air Defence ships did not have any long-range missile systems, and were consequently used in a warning and intercept role. These ships had practical ranges up to 170 miles on large aircraft flying in formations.[182] A British (or NATO) naval force would typically use such Air Defence ships as "radar pickets".[183] They were placed some 100-200 nm from the force, in the threat-direction. These ships were essential for giving early warning against the earlier discussed long-range Soviet strike aircraft armed with missiles of more than 100nm range.

Still, radars mounted onboard ships (and land) have the obvious limitation of line of sight due to the earths' curving. This crucial gap was to be filled by the AEW aircraft of the first generations. These early AEW aircraft had belly-mounted radars and did not have the capability of modern AEW aircraft to search in all heights. This was the reality for the UK, as well as the US and Soviet forces until the E3 Sentry and the Soviet Mainstay came about.

EORSATs (Electronic intelligence Ocean Reconnaissance satellites) in 1976. Both these systems were able to find and track naval surface forces.

[182] ADM 219/626, Air defence of Atlantic shipping (declassified SECRET).

[183] Naval War Manual (1957/1961), p.119.

In 1962, a large Air Defence exercise was conducted in the Mediterranean for the purpose of evaluating the effectiveness of the total capacity.[184] This "Exercise Poker Hand" included the Commander-in-Chief Mediterranean and the Sixth Fleet. The ships included the carriers Forrestal and Hermes, and a number of escorts. Aircraft as the Vixen, Phantom and Scimitars took part as attackers. The disposition (tactic) of the forces was as normal of the time: The carriers 50 miles apart at right angles to the AAW axis. Two escorts escorted each carrier. Three radar pickets and three AEW barriers were placed in front. This disposition was expected to give good warning, but they had true problems of holding a good picture in this area coloured by commercial traffic throughout. They also examined tactics where the carriers and most escorts were silent, but about two out of three enemy attackers reached bombing position. The tactics proved unsuitable against strike aircraft armed with missiles. Following this, large naval NATO forces have since tried to extend their early warning coverage by actively using all sensors.

Airborne Early Warning:

Beginning in November of 1951, the Britain received 50 AD-4W Skyraiders under the Mutual Defence Assistance Program (MDAP). They were intended to provide airborne early warning for the RN, and were designated *Douglas Skyraider AEW.1* in FAA Service. The Skyraider AEW first entered service in late 1951 with the 778 Training Squadron based at RNAS Culdrose, and this unit conducted British carrier trials aboard HMS Eagle. The 849 Squadron was the only unit to fly the Skyraider, and they maintained a Headquarters' Flight permanently based at Culdrose and four operational flights, which were detached for service aboard the carriers. One of these Flights was operating aboard HMS Bulwark during the Suez operation in November of 1956. The aircraft had 1 pilot and two observers. The RN made operational concepts based on the AEWs as autonomous units, as an opposite to the USN, which had the aircraft much more integrated. The two operators in the RN AEWs did both the search and intercept for defence

[184] ADM 1/28629, Exercise POKERHAND: air defence, air strike and Airborne Early Warning (AEW) aspects

against attacking aircraft. This was a basic interception, so the fighters still had to use own sensors in combat. The Skyriders also acted in a role for directing strike aircraft onto surface targets.[185] This is contemporarily labelled "third party targeting". The *Fairey Gannet AEW.3* replaced the Skyraider AEW.1 in active service by November of 1960. The Fairey Gannet, initially made as an organic ASW aircraft, was converted into this role and equipped with the APS-20 radar from the Skyriders. The APS-20 radar was slightly improved by 1967-68 to reduce clutter.[186] The radar had some 100nm detection range on large targets.[187] For the Gannet it was mounted in a radome underneath the centre fuselage. The Gannets were old aircraft, but were kept for the organic AEW role till the HMS Ark Royal was paid off in the late 1970s.

The previous discussion on the defence policy review of 1966 made a crucial blow to the Navy, when the carrier project for CVA-01 was disbanded. The lack of an AEW capacity to cover the North Sea and the Northern Atlantic after the soon inevitable retirement of the Fairey Gannet would then be hard to fill – according the naval authorities. Organic helicopters were assessed incapable of giving the necessary coverage for the Navy. The RAF was very active in promoting a concept of land based long range AEW, fully aware of the discussion. This would cover the need of all services in the area of the Northern Atlantic and the Norwegian Sea – and beyond. This was the solution one went ahead with. The RAF was expected to be equipped with a national made AEW Nimrod or the new American Boing AWACS. The Government opted for the Nimrod, but one recognized that there would be a gap for a few years that had to be filled.

Part-conclusion

As we see from this study of the technical and tactical capabilities of the British forces with roles within maritime Information Exploitation, all the roles refined in the conceptual framework were covered – but to a different degree.

(declassified SECRET).
[185] Naval War Manual (1957/1961), p.119-120.
[186] ADM 335/83, Fleet Air Arm Newsletter 1967 (declassified SECRET).

The fleet of Shackletons was the backbone for ordinary maritime surface surveillance, as well as for maritime photoreconnaissance. The number of aircraft does propose a great capability, at paper – but as for military aviation and air power in general, great numbers does not necessary equal great capabilities. The Shackletons radar sensor was poor for covering great areas, and the British capability to cover the areas surrounding the British Isles could not have been adequate against the Soviet forces, para-military intelligence vessels included. In case of ASW, the greatest flaw of the Shackletons comes in view. British technology had lost greatly to the systems of the US and Canadian forces. The LOFAR system was a necessity for keeping up with the growing numbers of Soviet noisy submarines. It gave both classification and far greater ranges than the elder cavitation detection systems. As stated, British ASW forces could not deal with any great percentage of enemy submarines. One interesting issue in case of inter-service rivalry is that RAF constantly tried to "push" the ASW responsibility over to the RN. This for two reasons: First, the RAF wanted RN to *not* focus on the role of strike against land areas, either tactically or strategically. Second, the RAF wanted to decrease own expenditures for ASW for concentrating more resources towards their more "air force roles" of strategic effect – the bombers, as well as to air combat aircraft.

As for surveillance of the air environment and early warning on aircraft, the FAA had well-suited aircraft for the era, as well as a reasonable number of aircraft available. It must be stated that these were not capable AEW aircraft as we expect them today – but the FAA AEW aircraft were fully capable of filling the vulnerable lack of low-level coverage of the ship-based radar systems. The ground-based air warning chain, as well as the naval concept of "picket ships" for early warning was also very good.

In case of SIGINT, great resources were used on surveillance of the great numbers of Soviet "fishing trawler" SIGINT vessels in the Norwegian Sea and UK waters in late 1950s and early

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[187] M.Gething, *Sky Guardians, British Air defences 1918-1993*, p.141.

1960s. This was a great concern for the RAF and GCHQ (Government Communication Hq) in lieu of the resources spent. Still, it was to risky not to control these activities. After a request from Thorneycroft to the Prime Minister in 1964, these task was somewhat relieved from the RAF, and taken on by naval vessels.[188] In general, British maritime SIGINT activity by use of aircraft were somewhat tuned down during the early 1960s. British independent ambitions were lowered, and many projects were cancelled by 1961. This was much due to the incidents of the U2 being shoot down in May 1960 (which actually did not include British activity), the downing of an American RB-47 "Ferret" aircraft over the Barents Sea – which had taken off from RAF Brize Norton, as well as the Crabb affair some years earlier in 1956.[189]

In total, the British aircraft and systems for Information Exploitation must be view as balanced and good, with an exception to acoustic surveillance and intelligence gathering, throughout the time-period.

[188] R.Aldrich, "GCHQ and Sigint in Early Cold War; 1945-70" in Intelligence and National Security (Vol.16,nr.1, Spring 2001), p.88.
[189] R.Aldrich, "GCHQ and Sigint in Early Cold War; 1945-70" in Intelligence and National Security (Vol.16,nr.1, Spring 2001), p.85-86.

Surface Warfare

British aircraft and systems

Surface Warfare is very much about sensors and weapon systems. A large number of aircraft, or great performance does not necessarily give an operational quality. The air-to-surface missiles used by the British strike aircraft were modern in design and operational capability. The most widely used short-range system; the American *Bullpup* air-to-surface missile was introduced in 1959. The missile was a short-range weapon with range of 10nm and it was radio-guided. The missile was also produced to be equipped with a tactical nuclear warhead. The FAA operated the missile on the Sea Vixen by the mid 1960s, as well as the Scimitars and Buccaneers. The equivalent French AS-30 air-to-surface missile was later introduced to some British aircraft. During the 1960s a program for a medium-range missile went on as a joint program of the Admiralty, Air Ministry and the Ministry of Aviation.[190] The naval side held up a requirement to hit a Kynda-class ship, or any equivalent air-to-surface guided-missile ship, and a 20-mile requirement was set forth. The missile became the Martel with a 60-mile range, but it was not operational till early 1970s. *Blue Steel* was the first operational British standoff missile, though mainly intended for land-attack. It was operational from 1961 till 1969, by when the Polaris took over the deterrent role. The missile was made for the V-force, Vulcan B2 and Victor B2. Blue Steel had a 1MT warhead[191] and a range of 100 miles for the attack aircraft to be able to launch with less chance of interception. Later in the 1960s updates came to slightly extend its range and low-level flight performance.

As for the aircraft, this era was truly revolutionary concerning jet propulsion and integration of computer technology. New aircraft designs came along before many production lines were

[190] ADM 1/28518, Air-to-surface strike weapon: Naval/Air Staff target and Staff requirement: submission to Defence Research Policy Committee (DRPC) (declassified SECRET).
[191] Armed with a 1MT nuclear warhead called Red Snow, based on US Mk.28 physics package.

completed. The US and the Soviet Union led the rapid evolution, and the British fought to keep up with a national capability to produce modern designs.

The 1950s and early 1960s saw numerous designs, some successful – but many faulty designs as well. The turboprop *Westland Wyvern* torpedo bomber and strike aircraft was operational from 1953, via the Suez crisis, till its early retirement by 1958. One aircraft intended to become the multi-role fighter of the FAA was the *Supermarine Scimitar,* operationally introduced by 1958. For the ASuW role it could carry the Bullpup air-to-surface missile. Some 70 aircraft were delivered to the RN from 1958. The last 24 ordered were never produced due to its unsuccessful story.[192] It was an early generation jet aircraft, haunted by technical flaws. It was well known for standing on the deck – leaking fuel in numerous buckets under its fuselage. For the ASuW role, the famous Buccaneers soon replaced it.

The *Blackburn Buccaneer* is probably one of the most successful British aircraft. The aircraft were purpose-built for the ASuW and land-attack strike roles, and the core feature was long range at high speed – low level. The experiences of FAA in Korea led to the requirement for a specialized low-level attack aircraft, but it has also been said that this aircraft was a purpose-built "Sverdlov Killer". The first development batch of 20 Buccaneers were ordered in 1955. By 1958 the first prototype flew, followed by the first deck landings on HMS Victorious the year after. The aircraft were operational with the 700Z out of RNAS Lossiemouth from March 1961. The improved Buccaneer Mk.2 went to successful trials on HMS Victorious in 1966. The aircraft were operational till late 1978, by when HMS Ark Royal paid off. The Buccaneers were capable of carrying nuclear bombs internally, as well as carrying anti-surface missiles as Bullpup and later Martel.

[192] D.Hobbs, *Aircraft of the Royal Navy since 1945*, (Cornwall: Maritime Books (1980s, unknown year of publication)), p.46.

For two decades from the early 1950s the *Canberra* filled the roles of reconnaissance and strike against enemy forces, mainly in the land-theatre – but also in the maritime. In the mid 1960s, several air-sea exercises saw the use of the Canberra in low-level attacks on naval forces.[193] The aircraft proved as a remarkable versatile aircraft. From 1965 onward it carried the French Nord AS-30 missile in addition to the rocket projectiles.[194] Strikes by light bombers against shipping were according to the naval doctrine clearly a role also for land-based aircraft.[195]

The *V-force* also had a strike role against the enemy offensive forces in the 1960s. Armed with nuclear weapons, even a naval moving target could be killed. This maritime strike role was officially noted in the 1966-defence review.[196] Also the naval doctrine noted that kiloton nuclear bombs could be used for both land and ship targets.[197]

The Skyraider AEW.1 with its APS-20 radar was also a significant asset for ASuW. The aircraft were labelled AEW, but were significant also in ASuW with its surface reconnaissance and targeting capabilities. The radar was down-looking, designed to cover the blind zones of the surface ship radars. Being developed to give warning on low-level strike aircraft, it was well suited for detecting surface targets as well. The Skyraider on area surveillance usually had both the role of detecting aircraft and surface forces simultaneously.

The new helicopters of the RN also had a role for reconnaissance and strike. The Navy was introduced to the tactical helicopter in 1952,[198] by when the US supported some Whirlwinds. They were mainly used for ASW, but were still utility helicopters also used for surface reconnaissance - and thereby part of the surface warfare capability. (The Whirlwinds are further

[193] AIR 41/85, p.71.
[194] AIR 41/85, p.69.
[195] Naval War Manual (1957/1961), p.121.
[196] Cmnd.2901.
[197] Naval War Manual (1957/1961), p.123.
[198] Prior to the British licensed build aircraft, 25 Sikorsky Whirlwinds were given to RN from the US under the Mutual Defence Aid Plan in 1952. This was for giving the RN helicopter experience. From 1954 the 845 Squadron used these helicopters to evaluate helo ASW tactics and concepts. (D.Hobbs, *Aircraft of the Royal Navy since 1945*, p.40).

described in the chapter on Subsurface Warfare). The Wessex had a crew of three and a whole range of weapons compared with the Whirlwind. It could for surface warfare purposes carry machine guns, rockets, as well as missiles. Initially equipped with the primitive Nord SS.11 wire-guided missile[199] and later the more capable short-range AS12 guided missile. The Wessex was initially produced as HAS.1[200] utility helicopter, and of which 129 were delivered.[201] The Commando Assault role was by 1966 taken over by the specialised HU5[202], while an improved HAS.3 was operational by 1967 for ASW and surface warfare. This HAS.3 introduced radar onboard naval helicopters, and was consequently assessed to become a truly new capacity for surface warfare. The sad fact was that the HAS.3 had grown too heavy, and even with new and more effective engines – it was haunted by technical difficulties. The Wessex HAS.3 was the first complete maritime tactical helicopter as we know them today, but its problems as e.g. its short endurance pressed for a new helicopter. The Wessex was replaced by the much more capable Sea King airframe by 1969-1970.[203]

The *Westland Wasp* was another third British maritime helicopter of this era. The Wasp was the first British helicopter designed to operate from ships other than carriers.[204] Of these surface ships, the HMS Leander was the first to operate a flight of Wasp. Following, 98 helicopters were delivered to the FAA from 1963 onward. This was a light general-purpose frigate helicopter. For the ASuW role against Fast Patrol Boats (FPB) it was capable of carrying AS-12 wire-guided missiles from the late 1960s.[205]

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[199] B.Gunston and D.Donald, "Fleet Air Arm 1960-69", p.192.
[200] HAS: Helicopter Anti-Submarine.
[201] 43 HAS.1 were converted to HAS3.
[202] HU: Helicopter Utility.
[203] The Westland Sea King helicopter buy had been approved in 1966, and entered service onboard HMS Ark Royal by 1970.
[204] D.Hobbs, *Aircraft of the Royal Navy since 1945*, p.64.
[205] ADM 335/83.

Part-conclusion

The great number of Shackletons gave a great surveillance and reconnaissance capability, as a necessity for effective anti-surface warfare. Also the strike aircraft were well capable of offensive operations. The forces still lacked the long-range weapon systems against maritime threats as of the Soviet Union. This would probably lead the British on the defences in any battle for sea control or denial in the northern Norwegian Sea. From 1957 the RAF was allowed to carry US nuclear weapons (, of which 60 weapons was kept under US custody as RAF bases)[206], and the use of such weapons were defined in the doctrines as a means of destroying naval targets. Still, these weapons were clearly meant for strategic nuclear deterrence, the prime focus of British forces after Sandys in 1957 – and it is doubtful if they ever would have been used for maritime warfare.

For operations in the littorals and for small-scale conflicts, the ASuW aircraft and conventional weapon systems were excellent. Not at least the easily available helicopters for the surface forces became important for these types of operations.

[206] R.Moore, "British Nuclear Warhead Design 1958-66: How much American help?" in Defence Studies (Vol.4, nr.2, Summer 2004), p.207-210.

Subsurface Warfare

British aircraft and systems

Subsurface Warfare traditionally includes mine warfare and anti-submarine warfare. For the heights of the Cold War the ASW role was very central and has been taking much of the focus away from mine warfare. In fact, mine warfare was central to the naval forces of both the NATO as well as the Soviet Union. Aircraft are excellent for laying mines. The naval doctrine stated mine laying of enemy ports and bases as a role of shore-based aircraft.[207] In case of MCM operations, the British also examined the application of towed wires for magnetic detection of submarines as well as wires for mine clearing. Minesweeping equipment was carried on some Whirlwinds from the late 1950s.[208] There was no British expertise on magnetic detection systems, and first some US and later some French systems were evaluated on some British Wasp helicopters in the mid-1960s.[209] Such systems never got any significant operational application to British forces.

ASW was the core focus of much of the Cold War; both for organic aircraft of the FAA and the land based long-range aircraft of the RAF Coastal Command. From early 1950s till late 1970s, both submarines and ASW developed rapidly, as described above with the Soviet submarine forces.

The Shackletons were the main ASW asset of Coastal Command throughout the 1950s and 1960s. To counter this Soviet submarine fleet build-up, especially the nuclear submarines, the main sensors gradually became the sonobuoys. The British had passive buoys that looked for propeller-noise of the Soviet submarines, as well as active buoys. In addition, the Shackleton used its ASV-21 search-radar and S- and X-band ECM equipment in ASW.[210] The Shackleton also had a diesel fume detection system called Utolycus, and an early magnetic system (MAD) to

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[207] Naval War Manual (1957/1961), p.121.
[208] B.Gunston and D.Donald, "Fleet Air Arm 1960-69", p.192.
[209] ADM 335/82.

look for submarines. The ASV radar was not effective for detecting submarines operating on periscope depth. This was a rare happening.[211] The APS-20 radar of the Fairey Gannet was actually much more capable of detecting small targets, and could even detect a periscope on occasions. The limitation of the AVS radar is also proven by the need of developing a smoke detector system for finding a close submarine at periscope depth charging its batteries by operating diesel engines. The MAD system of the Shackletons never got to work properly, and was abandoned by the late 1950s. The sonar system consisted of the T9003 directional passive sonobuoy and the T11514 directional active sonobuoy. The system was known as the Mk1c Sonar System. As for the capabilities of the system, it was assumed to have passive detection ranges of about 1000 yards per knot of submarine speed above cavitation speed. As an example: The Soviet Foxtrot-class could have a cavitation speed of 6 knots. If the Foxtrot were transiting at a speed of 11 knots, this would give a detection range of 5000y per sonobuoy. For the active sonobuoys, they used 3 frequencies between 20.4 to 23.0khz, and had detection ranges of about 2-3000 yards.[212] Still, up to the late 1960s, the active buoy indicating equipment could not display contacts outside 2000 yards.[213]

The buoys used by the British were large – 5 feet long and 9 inches in diameter and weighing about 80 lbs. They had to be carried in the aircraft's bomb bay, and subsequently took room from the torpedoes and depth charges. The Shackleton could not carry any large number of buoys. Anyway, the operators could just display two buoys in the Mk1c system simultaneously. The Mk1c sonar system never gave the British ASW forces any capability to search larger areas.

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[210] Air Publication 4267E, April 1965 "Shackleton".
[211] Not until the revolutionary Searchwater ASW radar came along in the early 1980s, were periscope detections so frequent that they put any significant pressure on and limitations to submarine operations.
[212] Air Publication 116G-0201-1 (3rd ed.), October 1968, "Sonobuoys active Mk.1c system".
[213] AIR 15/926, Tactical evaluation of the phase III Shackleton (ASWDU trial 427) (declassified SECRET).

A British analysis report from trials of the Shackleton in the mid-1960s gives the acoustic system, its radar and navigational and weapon system poor appraisal.[214] First about the radar: Submarine contacts could at the best be achieved at some 6-12 miles. These were the tests ranges used. Even then, the navigational system was so poor that it normally had offsets of about 600-900 yards. With the realities about the Mk30 passive homing torpedo, which had to be dropped within 900 yards of the target, and the Mk44 active homing torpedo that only had an acquisition range of about 400 yards – an attacked disappearing radar contact (DRC) was seldom killed. The crew had to drop buoys to relocate the submarine. Single buoys gave poor detection percentage, so patterns of buoys had to be used. Tactical sonobuoy-patterns called P-A-P[215] and PA-PA[216] were used in the 1960s. The relatively poor kill rate by both air, submarine and surface forces in submarine hunt, as well as the acceptance that tactical nuclear weapons would be used – led the British forces to buy the AS-1200 nuclear depth bomb by the late 1960s for the Shackletons.[217]

The British were years behind the developments of the US and Canadian "Julie" and "Jezebel" sonar systems. The Julie-system was an early multi-static system of explosive echo ranging (EER[218]), and was designed to give long active sonar ranges in deep water. The passive Jezebel system comprised the CODAR (Correlated Detection And Ranging) and the LOFAR (Low Frequency Analysis and Recording) systems. The CODAR system was the pairing of information from two buoys, where the incoming signal was correlated to provide bearing to the sound-source. The LOFAR-system enabled the operators to analyse the acoustics in a wide spectre for recognition of submarines, even down to "fingerprints" of single submarines. This became very important for the Cold War ASW play, especially as the nuclear submarines came into service. Tests in 1959 proved some 30nm range for LOFAR, and 20nm for CODAR against

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[214] AIR 15/926.
[215] Passive-Active-Passive. Three buoys in the water with 2000yards spacing.
[216] Two sets of Passive-Active buoys colocated, 1000yards spacing on each side of datum.
[217] AIR 10/8643, Medium capacity air-to-surface bomb: use in Shackleton MR Mks 2A and 3; amendments 1-16 (declassified SECRET).

British and US submarines.[219] These capable systems first came to the British forces with the Nimrod by the early 1970s.[220]

The Shackleton had served well, but its flaws were too great, and the new standards set forth by the P3 Orion pressed forward a replacement. Even in 1960, just after a re-modernisation, the Shackleton was assessed inadequate and a replacement requirement was in place.[221] By the mid 1960s, the Shackletons became haunted by fatigue problems, and aircraft had to progressively be withdrawn from squadrons to be reconditioned.[222] The Nimrod replaced the Shackleton by 1969-70 as previously described. This gave the British forces a great step forward – not at least for ASW.

As for *organic ASW aircraft*, the RN got its first aircraft capable of combining search and attack roles in one single aircraft operational in 1955 – it was the *Fairey Gannet*. The Fairey Gannet had one pilot, one tactical observer and one aircrewman. The aircraft were capable of carrying two Mk30 passive homing torpedoes, as well as bombs, depth charges and rockets. The ASW aircraft were retired in 1960, as the naval helicopters proved effective. The *Whirlwind* helicopters were operational by 1960, and soon followed by the Wessex in 1961. These first organic helicopters were used in a range of missions. The Whirlwind had in addition to the ASW role (search *or* attack), capability of surface reconnaissance, Commando Assault, search and rescue and logistic support. The Whirlwinds were delivered in two main configurations, the HAR[223] and the HAS[224]. The HAS.7 being the main ASW helicopters, with a crew of three. The HAS.7 ASW helicopter had provision for only one MK30 passive homing torpedo. When

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[218] Contemporary understanding of the abbreviation is Extended Echo Ranging. (As it may used other transmitter than explosives).
[219] AIR 15/948, Review of operational experience with sonobuoys and suggested future policy (declassified SECRET).
[220] In 1968 the UK Ministry of Defence adopted the US and Canadian LOFAR technology to complement more basic British designs. British LOFAR solutions began to take shape in late 1969 with the production of SSQ-48 (T24501) Jezebel sonobuoys (http://www.ultra-ussg.com/company/sonobuoy_history.cfm , June 2004).
[221] AIR 41/86, p.173-174.
[222] AIR 41/86, p.280.
[223] The HARs were assault aircraft. (Covered in chapter on force projection).

carrying a torpedo it was not possible to operate the dipping sonar. This required the helicopters to operate in pairs for being able to do search and attack. The Whirlwind HAS.7s started replacing the Gannet ASW aircraft from 1957 onward but suffered from great technical problems. It was from the early 1960s already an obsolete helicopter design, and was soon replaced by the more modern Wessex. The Westland Wessex ASW helicopters, first the HAS.1 utility batch, later followed by the more specialized – but somewhat unsuccessful HAS.3.[225] The HAS.1 were equipped with the T.194 dipper sonar and carried the active Mk44 and by the late 1960s the more modern Mk46 torpedoes. It also carried Mk11 depth charges. The Wessex was the first British helicopter capable of night and all weather dipping operations – which was a tremendous and crucial necessity if the helicopters were to have any extensive responsibility for the force operating in the northern areas between Britain and the Soviet naval forces during winter-time. This was also a great step forward for all nighttime and poor weather operations all around the world. Due to the HAS.1's problems with endurance, it had to be used in either a search-role or attack-role.[226] The T.194 sonar had normally a 3000-yard detection range,[227] and without torpedoes loaded, the Wessex was able to cover up to 140sq.miles[228]. The later HAS.3, operational by 1966, was not a success due to technical problems, but the batch introduced a new era of helicopter capacities with the introduction of the search radar.

The light helicopter *Westland Wasp* also had an ASW role. Its birth was very important. Since, light-medium helicopters have constituted an integrated and multiplier part to all types of naval ships. The Wasp carried the passive Mk30 torpedo and later the active Mk44, as well as Mk11 depth charges. The Wasps did not have any search sensors, and were tactically operated as an

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[224] 120 HAS 7 ASW models were delivered to the RN. HAS 9 were SAR versions of converted 7's.
[225] Previously discussed in chapter on surface warfare.
[226] ADM 219/453, Future A/S helicopters: improved Wessex (declassified CONFIDENTIAL).
[227] ADM 219/453.
[228] The T.195 sonar was tested on some Wessex aircraft, but did not really come into operational large scale service till 1969 with the Sea King. It had better range and thereby better coverage.

attack unit, which delivered weapons on targeting directions from other units (another dipper helicopter or surface ship contacts).

The introduction of the helicopter was an important event in modern naval history. The multi-role capabilities and especially the ASW dipping sonar system proved so effective, that many nations started building a new class of ships – the helicopter ASW carriers, or helicopter destroyers often called due to political reasons and international restrains on carrier forces.

Part-conclusion

The Schakletons ASW capabilities were poor compared with American technology, as well as against the threat posed. A reasonable high number of aircraft still made the British capable of ASW. There where also operational and tactical concepts made for air-sub cooperation procedures, but the slow production pace of British nuclear hunter-killer submarines made these forces incapable to match the growing numbers of Soviet nuclear submarines. The conventional British submarines were not able to match them in terms of speed, range or underwater performance.[229]

The one positive development was the introduction of the dipper sonar, which improved the classical defensive convoying system greatly. The helicopters must be reckoned as one of the greater technological inventions of Maritime Air Power in this era. It greatly enhanced all from short-range ASW to effective control of shipping in defined areas by its reconnaissance capabilities. The helicopters were first employed on the existing carriers, but soon became available to and even crucial extensions of smaller surface ships. Still, the helicopter as a platform saw many challenges for these initial years – so the helicopter ASW effect is somewhat hard to evaluate for this time period.

[229] K.Young, "The Royal Navy's Polaris Lobby, 1955-62" in The Journal of Strategic Studies, Vol25, nr.3, September 2002, p.59.

In the greater picture, the large numbers of Soviet submarines described earlier, eventually nuclear powered and with missile capabilities -- and the poor status of British ASW search and attack systems made this a time of crisis for the British ASW forces.

Air Control Warfare

British aircraft and systems

Air Control Warfare is first of all crucially dependent on effective air surveillance, as previously discussed under the chapter of Information Exploitation. This was a hard lesson to learn for the British forces during the Falklands War. But, having this in place, it is further necessary to discuss and describe both organic and land-based fighter aircraft. In the British case, it was clear that also shore-based fighter aircraft of this era had a role of air defence of shipping.[230]

The organic *Hawker Sea Hawk* was designed at the end of the Second World War, but an operational design was not available for the Korean War. The aircraft was finally operational by 1953, with never ending modifications up till its early retirement after the Anglo-French Suez operations in November 1957. The aircraft had been the backbone of the FAA for most of the 1950s, but was just too underpowered to keep up with more modern jet-designs in dogfights. The British were continuously chasing the developments of the USA and the Soviet Union for aircraft design in this era. The *De Havilland Sea Venom* was designed for the fighter and escort roles; and had night- and all-weather capability. The armaments were canons in the nose and some few later aircraft were capable of carrying the Firestreak air-air missile. This early British heat-seeking missile moved air combat into a new era. The Firestreak had an effective range of 4 miles, but were solely for rear hemisphere attack. The missile was still so successful that for the first 100 launches, the engineers learned practically nothing new of any potential weaknesses of the new weapon.[231] The Sea Venom could also carry a small number of bombs and rockets. The aircraft first flew trials from HMS Illustrious in July 1951, the first front line aircraft flew in

1953 – followed by the first operational squadron, the 809s, by the next year. The Sea Venom replaced the Sea Hornet for the night fighter role, and got to see extensive combat missions in the Suez operation of November 1956. The Sea Venoms had to take much of the air cover and escort roles of the RAF, due to the long transit they had from Cyprus and Malta. The Sea Venoms operated from the HM Ships Eagle, Albion and Bulwark during this conflict. The Sea Venoms, some finally with the modern Firestreak, did their first line duty from 1954 to 1960, by when all were replaced by the Sea Vixen.

The navalised *De Havilland Sea Vixen* first flew in 1957 and was fully operational by 1959.[232] It was a promising air-air combat aircraft for the FAA. It was some ten years after the US equivalent F3D Skyknight, but able to match most possible enemies. The Sea Vixen FAW.Mk.1 was the first FAA fighter not equipped with guns. It was to fully rely on the new AI18 radar system and air-air missiles. This was a successful and modern, even multi-role aircraft for the FAA till 1972. By 1963 an improved Sea Vixen FAW.2 variant became operational. It had improved ECM capabilities, as well as a capability to carry the Red Top missile. The Red Top missile was initially an upgraded Firestreak (originally called the Firestreak Mk IV). It had improved range, warheads and limited all-aspect infrared seeker head to intercept the target. The Red Top was in addition to the Sea Vixen, deployed on the RAF Lighning till her retirement in 1988.[233] The Sea Vixen, though subsonic, was the principle FAA organic fighter for air combat throughout the 1960s. The aircraft made its position during the Kuwait crisis of 1961, when Iraq was about to invade, but pulled back on his plans after strong British carrier presence in the Persian Gulf. The Sea Vixen and the carrier HMS Centaur also made a tremendous effort in January 1964, supporting air cover for the marines landing troops in Tanzania, as well as the RAF transports flying in. The final operational tasks of the Sea Vixen, was to oversee the

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[230] Naval War Manual (1957/1961), p.121.
[231] http://ww.pmulcahy.com/aams/british_aams.htm , March 2004.
[232] B.Gunston and D.Donald, "Fleet Air Arm 1960-69", p.188-189.

withdrawal of British forces from Aden in 1967. The Sea Vixen operated then in cooperation with the Buccaneers. The Sea Vixen was retired from first line service in 1972 with the HMS Eagle, and replaced by the McDonnell Douglas Phantom.

In case of the RAF, the Air Ministry fought for acquiring a fighter interceptor capable of taking on the increasing modern Soviet bombers. Two separate designs, one day- and one night-fighter were envisaged. The day-fighter requirements led to the beautiful *Hawker Hunter*. It became operational just prior to the Suez crisis of 1956. The aircraft were stationed at Cyprus to fly escort for the RAF bombers. Due to the long transit they did not really play any significant role, and the organic fighters of the FAA became important additions for the escort and air combat roles. The range was one flaw of the conventional gun-armed Hunter, another became obvious when operating with other NATO countries: the American F-100 Super Sabre easily outperformed it by the late 1950s. The design of the Hunter was not supersonic – and it soon had to give way as an air-air fighter by 1960.[234] As for the night and all-weather requirements of the RAF, the *Gloster Javelin* came to service in the 1950s. It was produced in numerous versions, but was not truly an operational asset until the early 1960s, and then even retired from Costal Command by 1964. The Javelin was the RAF's ever delta-wing fighter, and the first missile armed interceptor. It had good air radar of the time, and was put in a pure intercept role to guard Britain against the Soviet bombers.

The cry for a supersonic fighter to replace the Hunters and the Javelins came all from the beginning of their operational service. The project of the *English Electric Lightning*[235] came along early in the 1950s. The Lightning was operational by 1960 and was the first and only designed and built supersonic interceptor of the RAF. The aircraft gradually replaced the Hunters and the Javelins for the air combat role. The Lightning was equipped with two Firestreak

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[233] http://www.skomer.u-net.com/projects/redtop.htm , March 2004.
[234] The Hunter had a short career as an air-air fighter, and was soon converted to ground attacker for army support.
[235] English Electric Lightning became British Aircraft Corporation (BAC) Lightning by the 1960s.

infrared homing missiles and guns. Though supersonic, and ranked as one of the greater British fighter designs, this aircraft had its great flaws. In the air combat role, the Lightning had a disadvantage with the inlet-design and the nose of the aircraft, resulting in poor radar performance.[236] This was a great disadvantage for advanced air-air combat, but then – it was designed as a true interceptor to deal with the Soviet long-range bomber and strike aircraft fleet. For this role the GCI sighted the bombers and scrambled the Lightning from alert. The Lightning used most of its fuel to climb to 35000 feet, accelerated to 1,5M, for then to be directed for a one-pass stern intercept to engage with the Firestreak missile (or the Red Top from F3 batch).[237] The Lightning then only had fuel for return to base.

In the time period 1957-62, Air-Air Refuelling (AAR) became an accepted and important part of Air Control Warfare, and the British built their tanker force from converted V-bombers.[238] This was a reality that had great importance for Maritime Air Power in general, but also for the relationship between the FAA carriers and the land based forces. The RAF could now offer, or at least argued for a full coverage of the North Sea by land-based air power. This may have been one of the prime factors leading to the later cancellation of CVA-01. In Britain, the first standard AAR aircraft was the Vickers Valiant. These were only operational till 1964, by when they were pressed by fatigue, and replaced by six Victor B(K)1As by 1965. Subsequently 24 Victor B1s were converted to tankers from 1966 onwards. These had an operational range of 2500 miles and were capable of night operations. With these aircraft and their technical capabilities, land based Air Control Warfare has to be included in discussions on Maritime Air Power. Ground-controlled intercepts, AEW support and refuelling made them capable of taking part in the conflicts at sea to a far greater extent than previously. The Lightning made an important interceptor capability for the maritime theatre surrounding the British Isles.

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[236] The new A123 radar system was advanced by the time, but inlet design limited its size as well as limited the view sector.
[237] M.Gething, *Sky Guardians, British Air defences 1918-1993*, p.124.

Naval surface-to-air missile systems:[239]

The British surface-to-air systems of the 1950s and 1960s were designed as point defence systems. In the 1950s, the gun had the main role for this defence; later the Seacat short-range missile replaced most of the traditional anti-aircraft guns. The Seacat system entered service on HMS Devonshire in 1962. The missile had a maximum range of 4.75km and was steered by radio-command guidance and the target could be tracked visually or by radar. The Seacat system provided a simple but effective close-range air defence system, and was gradually fitted to almost all British and some foreign warships. Air defences for British ships became more effective by the 1970s. The medium-range Seadart was introduced for testing in the late 1960s and proved effective. In addition, rocket launched chaffs became operational for confusing incoming radar-guided missiles.

Part-conclusion

The British capabilities of the early warning systems to detect and give early warning on strike aircraft with long-range missiles were good. This was true for both the ground stations, the naval "picket ship" concept, as well as the naval organic AEW aircraft. On the other side, the British FAA fighter aircraft and the land-based fighters were not nearly capable to secure the Norwegian Sea from Soviet air strikes on the British surface forces, nor to stop the Soviet air armada of strike aircraft aiming for the British Isles. As Gunstan and Donald stated: " In the early 1960s the FAA had no fighter of a kind that might be expected to win in close combat, for example against a Mirage, F-5 or Mig-21".[240] In addition the numbers, especially in case of the RAF, were far too limited.

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[238] AIR 41/85, p.93-99.

[239] Land based surface-to-air missile systems are in the haze of the defined lines of Maritime Air Power, still – the long-range systems clearly have implication for the maritime air forces operating in the littorals, as well as they are alternatives to the combat aircraft in the same theatre. Long-range air defence missiles able to cover greater parts of the maritime theatre are to be included in Maritime Air Power and must be accounted for. In the British case, the planed long-range missiles of the Stage-plan were never brought into service, and the land based air defence missile systems never got a significant maritime role.

[240] B.Gunston and D.Donald, "Fleet Air Arm 1960-69", p.197.

The total maritime Air Defence concept was examined by a study of the Admiralty in 1960.[241] They looked at the proposed "second phase", following the initial nuclear strikes. This was the proposed scenario of maritime warfare. The Admiralty expected that a large number of the long-range bombers would be destroyed in the initial strategic exchange. Consequently, they examined their forces up against an attacking force of 50 Mach 2 bombers. The remaining Soviet air strike forces would not be able to halt all communication to the British Isles. The problem was to get this sinking rate down to a "tolerant number", e.g. 400 ships a year. Convoys of 300 – 600 ships were considered, but this would again give a too great a target for the air strike forces with long-range nuclear missiles. As for the argued and recommended tactics for effective Air Defence, attack on the bases (in good RAF tradition) was considered most effective. Still, this was not likely to be effective since the Soviet forces were so spread out. The second alternative was to provide Air Defence barriers of carriers, missile ships and land-based aircraft in the gap north of Scotland. As for the carriers and missile ships, these would be intolerably vulnerable to the great submarine threat. The solution had to be large convoys escorted by large and balanced forces, but the outer "radar pickets" for early warning would be very vulnerable to submarine attacks. The British air-to-surface missile systems were assessed not adequate, and one carrier was proposed for a 100-ship convoy and two carriers were required for up to 600-ship convoys.[242]

In lieu of the threat posed by the Soviet air strike forces, and the performance and numbers of British air-air combat aircraft - it is hardly possible to say British air defence aircraft were adequate to protect the British territory. The British aircraft were hardly competitive to the powerful land-based strike aircraft of the Soviet Navy. As for the maritime communication lines, the British forces in co-operation with NATO could possible defend one 300-600-ship convoy at the time.

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[241] ADM 219/626.

Force projection – the "fifth" core capability

Force projection by Maritime Air Power is about two categories. First, strike by delivering weapons against maritime targets at shore and attack on naval vessels at port – and secondly force projection by landing forces ashore.

The latter, amphibious warfare, has a solid position in British military thinking. This was very perceptible in this period as several carriers were more or less permanently used as assault ships after the introduction of the helicopter in the late 1950s. The two best known, the HMS Bulwark and HMS Albion made great effort in Kuwait in 1961, Brunei in 1962, as well as in Borneo from the early 1960s till 1966 with their commando troops and helicopters. The flashy operation against Kuwait's new airfield in 1961 is a good example of force projection by Maritime Air Power. The Whirlwind HAS.7s of 848 Squadron rushed in the No.42 Royal Marine Commando from Bulwark. The Marines then secured the airfield for the RAF Hunters to move in for deployment.[243] The operation in Brunei came after the Sultan had asked for help against guerrilla attacks from Indonesian territory. HMS Albion was heading for Singapore with the No.40 Royal Marine Commando at the time, and was immediately re-routed to assist by landing its forces ashore.[244]

As for delivering weapons on maritime facilities and attacking ships at port, this is in operational sense very much the same as conducting ASuW. The targets are mainly the same mobile forces, and the threats are mainly the same as all normal operations in the littorals. Still, this is clearly a diffuse and haze area between Maritime Air Power and air power theory and concepts in general.

In case of the FAA, their Hawker Sea Hawks made a great contribution as an air-ground attacker against the Egyptian shores in the 1957 conflict. They were operated from HMS Eagle, Albion and Bulwark. Still, the Sea Hawk was obsolete by modern standard of aircraft design and was

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[242] ADM 219/626.
[243] B.Gunston and D.Donald, "Fleet Air Arm 1960-69", p.199-200.

soon later retired. The FAA's next strike aircraft for force projection was the Scimitar. This technically unsuccessful[245] multi-role aircraft had its only operational role in ASuW and strike on land targets. Both the Sea Vixen and the Scimitar were announced to be equipped with tactical nuclear weapon for the force projection strike role. Still, no such weapons were ever issued to the Squadrons.[246]

Accepting this as a haze area, it is also clear that the ordinary RAF bombers and strike aircraft played an important role. The V-bombers, especially after they had lost their nuclear deterrent role with the cancellation of the Skybolt in 1962, and the introduction of the Polaris to take on this role, became a true capacity for the maritime war. The Buccaneer was the principal ASuW and land-attack strike aircraft of the FAA. It had by 1966 relieved the other aircraft of this role.[247] The Canberra strike aircraft was further an important asset of Maritime Air Power in this perspective. These aircraft, the V-bombers, the Buccaneers and Canberras have been well covered in the previous chapter on Surface Warfare.

Force projection by *amphibious warfare* is definitively one of the more advanced forms of warfare. An amphibious operation is fully dependant on the other core capabilities of Information Exploitation, Surface and Subsurface warfare, and not at least air defence – both prior to and during the operations. As for the amphibious landing specifically, Maritime Air Power became an important factor after the introduction of the organic helicopters for landing troops, as well as for evacuating. The assault role of the Whirlwind and the Wessex proved its existence all from the beginning. The Whirlwind HAR versions for troop support and utility successfully conducted the first helicopter assault landings during the Suez crisis of 1956. The 845 Squadron operating from the HMS Ocean landed men from the 45 Commando Royal

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[244] R.Sturtivant, *British Naval Aviation. The Fleet Air Arm 1917-1990* (Annapolis: Naval Institute Press, 1990), p.192.
[245] ADM 335/82.
[246] B.Gunston and D.Donald, "Fleet Air Arm 1960-69", p.193.
[247] D.Hobbs, *Aircraft of the Royal Navy since 1945*, p.46.

Marines.[248] This was such a success that the concept was persuasive, and from 1960 onwards Whirlwinds equipped specialist Commando Assault squadrons on the converted carriers HMS Bulwark and HMS Albion. As for the Wessex helicopters, the first batch of HAS.1 were true multi-role, and was used for the assault role in the Far East during the confrontations with Indonesia in the early 1960s. From 1966 onwards, a specialised assault version, the Wessex HU5, was taken into service for this role.

Amphibious warfare became a core focus for the British forces. This focus is well pointed out in the 1966 Defence Review as one of the rationales behind the cancellation of CVA-01.

[248] D.Hobbs, *Aircraft of the Royal Navy since 1945*, p.58.

Conclusion

Through the first part of the dissertation, a attempt of an cross-service description of Maritime Air Power was put forward. The elements of Maritime Air Power have been argued to include the maritime objectives, some core capabilities and the applied roles of air power. It is essential to appreciate all these levels to get the comprehensive understanding of this complex field of military art – which is both about sea and air power. One can hardly achieve a fully understanding the operational and doctrinal aspects without a study of the tactical and technical aspects of air power. Similar, one can hardly understand maritime Air Power without knowledge about sea power and the maritime objectives. The study of Maritime Air Power show that it is fundamentally joint – and thereby it is necessary to take into account the differences in culture, terminology and doctrine. My point is that maritime air power must be recognised wholly as both air power and sea power. The one service that disregards this has not got the grasp of the subject.

The conceptual framework of maritime objectives, core capabilities and roles proved very useful. It was very good for applying methodically to the case study, especially the case of including a level of core capabilities or warfare areas. This level is often skipped, and thereby one often loose sight of the span of roles within the field of Maritime Air Power. Maritime Air Power is so much more than just ASW and ASuW.

The definition made on Maritime Air Power has not been challenged during the study, and consequently stands firm as a good starting point for dealing with air operations in the maritime theatre.

> *"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".*

To sum up on *the elements of Maritime Air Power*, a matrix may describe them systematically:

Maritime Air Power	
Objectives **The practical objectives of Sea Control, Sea Denial and Force Projection**	
Core capabilities	***Roles***
Information Exploitation	Intelligence Surveillance Reconnaissance
Surface Warfare	Anti Surface Warfare (ASuW) Maritime Interdict
Subsurface Warfare	Anti Submarine Warfare (ASW) Mine Warfare (MW)
Air Control Warfare	Air Defence (AD) / Anti Air Warfare (AAW)
Force projection	Air-land strike Amphibious operations

Figure 4: The elements of Maritime Air Power (Dyndal, 2004).

The following case study was made schematic as of the conceptual framework. This was intended to be an alternative approach to the two most used perspectives; namely a perspective of the services, the Fleet Air Arm versus the Coastal Command, or the second most used perspective; by aircraft and platforms.

The case study on the British Maritime Air Power of the era 1957-67 was at the strategic level coloured by a two-fold mission. The prime concern was the Cold War and a nuclear war between the superpowers. The practical maritime objectives in this case were focused on ASW and air

defence for protection of shipping. Secondly, the British were dwindling their colonial interests. In this context, amphibious warfare was prioritised – supported by a balanced fleet around the carriers. An understanding of this *two-fold mission dilemma* gives light to the military strategic rationale, as well as the cross-service rivalry and balancing of forces during this era. As Middkeke explains:

"Britain's failure to cut military commitments in spite of escalating defence costs was not the result of blocking politics by disgruntled services. Rather, there was no determination among Whitehall's political departments to cut commitments even before the service departments could obstruct a decision on force levels."[249]

At the doctrinal level with the war manuals and in general writing, the focus was somewhat different between the services. The naval war manual and the Admiralty were very traditional, with a continuing focus on the conventional carrier and the balanced fleet for East of Suez missions. The shift-over to a new focus came first with the Polaris system; a decision there saw much in-service discussion. The fear was that this would make the end to a balanced naval fleet, somewhat in line of what happened to the RAF after the Sandys review. To a degree, this came to be the situation for maritime forces after the Polaris.

The air manuals after the Second World War, and not at least many military philosophical articles (e.g. by Slessor) tried to a greater extend to think of air power in new terms. This was of course positive, but I will still argue that they went far beyond realities in some of their arguments on how air power would reveal the naval surface forces of their traditional roles.[250]

Despite these differences in view, and the many inter-service rivalries of the era – the doctrines, both the naval and air war manuals, were well balanced. At the doctrinal level, British forces

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[249] M.Middeke, "Britain's global Military Role...", p.143.

[250] Especially the article by Slessor: "The change over from sea power to air power". Also the Trenchard phamplets: "*The Principles of Air Power in War*", "*Air Power and National Security*" and "*The Effect of the Rise of Air Power on War*" from the 2WW.

were well prepared for all aspects of warfare in the maritime theatre. The war manuals also described the roles of Maritime Air power in a reasonable good way – at least better than the contemporary British doctrines.

After looking at these strategic objectives and the focus of the air and naval services of the era, I examined more in depth the technological and tactical state of the British forces. The doctrines were well descriptive in case of Maritime Air Power, while at the technological level many deficiencies were identified.

In case of the core capability of *Information Exploitation*, British Maritime Air Power aircraft and systems were balanced, with good capabilities for the roles of surveillance and reconnaissance. As for intelligence collection, the capabilities of British acoustic collection were inadequate. The systems were not LOFAR, only made for cavitation detection. This in turn had great negative effects for British *Subsurface Warfare*, or more specific, the air ASW capacity against the increasing numbers of Soviet nuclear powered submarines in this era. The comparative US and Canadian systems were years ahead for ASW against the nuclear submarine. At the doctrinal level, as well as for the organisation of forces - the British forces kept their ASW focus from the Second World War. Still, the submarine threat of the Soviet became increasingly and almost impossibly great during the 1960s.

The Maritime Air Power forces, which had roles within *Surface Warfare*, were well suited for littoral and limited war scenarios. A reasonable amount of aircraft, armed with modern missiles, as well as concepts for third-party targeting were in place. As for a more blue water conflict against Soviet surface forces in e.g. the Norwegian Sea – the capabilities were not adequate to match Soviet systems. British Maritime Air Power did not have any long-range missile systems, nor did the British surface navy (for possibly using aircraft for target reporting).

The significance of the fourth core capability of Maritime Air Power, *Air Control Warfare*, has too often been overlooked or taken for granted. I have argued this role as essential to maritime

warfare – as a prerequisite for the other forces. The British forces had a great number of aircraft for air combat, both land-based and organic with the FAA, all up to late 1950s. For the period of this study, and following the 1957 Sandys review – which doomed the combat aircraft outdated and to be replaced by air defence missile systems, the British capability for effective air defence were effectively broken down. The years following saw a great reduction in RAF air combat aircraft. In addition, the long-range air defence missiles of the Stage plan, which was to replace these aircraft, never came to operational service. The RAF air defence capability must be viewed as inadequate for defending either the British Isles or any naval forces out at sea against a Soviet air attack. Some of the aircraft were reasonable good aircraft, even armed with advanced missiles of the time – but the numbers of aircraft had simply been cut far beyond any acceptable standard.

The core capability of *Force Projection* got increase significance from the late 1950s, and have very much kept its position in British maritime strategy ever since. Carriers were refitted for a dedicated Force Projection capability, and the new helicopters on the scene became the central player. I will conclude that the new helicopters, even important for ASW and ASuW, by far had its greatest contribution within this field with its mobility, and even made this focus possible for British military forces.

In the greater perspective, the British Maritime Air Power forces of RN and RAF were well balanced for the period 1957-67 in the sense they could take on all types of roles when needed – even though they were not able to match a Soviet offence against the British Isles or British lines of communications. Both in case of Air Defence and ASW, a combined NATO or US force was needed all from the outset of a conflict.

Leaving this era, Maritime Air Power saw new great changes. This next era should receive a in-depth study in the future as official documentation are becoming available. The cancellation of CVA-01 in 1966 had great impacts on FAA in respect to Air Defence primarily. The Sea King helicopter was a more mature helicopter design, both in case of the helicopter per se and the

systems, and the ASW capabilities were taken a great leap forward. The same was even truer for the RAF, which got the Nimrod and modern ASW systems to relieve the obsolete Shackletons.

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Abbreviations

AD	Air Defence.
AEW	Airborne Early Warning.
AJP	(NATO) Allied Joint Publication.
ASuW	Anti-Surface Warfare.
ASV	Air-to-Surface-Vessel (radar).
ASW	Anti-Submarine Warfare.
AWACS	Airborne Warning and Control System.
CVA	Aircraft Carrier, Attack.
CODAR	Correlated Detection And Ranging.
ECM	Electronic Counter Measures.
ELINT	Electronic Intelligence.
ESM	Electronic Support Measures.
FAA	(British) Fleet Air Arm.
ICBM	Inter-Continental Ballistic Missile.
ISR	Intelligence, Surveillance and Reconnaissance.
LOFAR	Low-frequency Analysis and Recording.
MAD	Magnetic Abnormality Detection.
MCM	Mine Counter Measures.
MPA	Maritime Patrol Aircraft.
MW	Mine Warfare.

RAF	(British) Royal Air Force.
RN	(British) Royal Navy.
SAM	Surface-to-Air Missile.
SLBM	Submarine Launched Ballistic Missile.
SLOC	Sea Lines of Communication.
SOSUS	Sound Surveillance System.
SSBN	Ballistic missile submarine, nuclear.
UAV	Unmanned Aerial Vehicle.
AAP	(NATO) Allied Administrative Publication.
AAR	Airborne Air Refuelling.
AAW	Anti-Air Warfare.