MINISTRY OF DEFENCE

Joint Concept Note 1/12

Future 'Black Swan' Class Sloop-of-War: A Group System

DCDC

JOINT CONCEPT NOTE 1/12

FUTURE 'BLACK SWAN' CLASS SLOOP-OF-WAR: A GROUP SYSTEM

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PREFACE

'The reader must prepare himself for what looks like a reversal of policy; but which indeed had been the real policy throughout. No sooner had I won from the Cabinet the authority to order the four super-dreadnoughts of the year 1914 than I immediately resumed my plans for converting two of these ships into a much larger number of smaller vessels. I proposed to treat these dreadnoughts not as capital ships but as units of power which could, if desirable, be expressed in any other form….. It was necessary to proceed in great secrecy. How could I ask the Cabinet and Parliament for four super-dreadnoughts as a vital matter in March [1914] and then transform two of these precious machines into thirty or forty submarines and torpedo-craft a few months later?'

Winston Churchill 1914[1]

1. The future 'Black Swan' class sloop-of-war is a manned ship that will act as the core for a group of manned and unmanned platforms which, as an integrated system, will provide the units of power required by those surface assets[2] tasked with the protection of sea lines of communication and sea control. At an acceptable financial cost and operating in groups, the sloops will provide both the quantity of platforms, and the quality of systems, that will be demanded of the Royal Navy in the future operating environment. In operations other than war, the increased hull numbers will provide the capabilities required to fulfil the maritime security tasks demanded by a maritime nation as well as the global presence required to engage with the international community.

2. The name of the concept is drawn from the 'Black Swan', and modified 'Black Swan', class sloop-of-war, which were built during World War II to protect shipping and gain sea control. '*The concept was to combine the three types of sloop emerging in 1937 into one type for rapid production*'.[3] Although the modified 'Black Swan' class lost its minesweeping capability to become a more highly specialised gunnery vessel, the original units were

[1] First draft of Sir Winston Churchill's, *The World Crisis,* Chartwell Trust: Churchill Papers, Churchill College, Cambridge, 8/61, folder 28.
[2] This would include frigates, destroyers, mine countermeasures vessels, hydrographic and oceanographic vessels, patrol vessels, and their complementary assets/capabilities.
[3] Elliott P, *Allied Escort Ships of World War II – a complete survey*, Macdonald and Jane's Publishers Limited, 1977, page 137.

ocean-going warships capable of minesweeping, minelaying, anti-submarine, anti-ship and anti-aircraft warfare; they also had a 25-foot fast motor boat and a 27-foot whaler. Like this concept, the key to the tactical proficiency of the sloops was not the single ship but rather the 'group system' with capability measured collectively in groups rather than individually in single platforms. Captain Johnnie Walker's 2nd Support Group, which, comprising of 6 'Black Swan' class sloops, was the most famous and successful anti-submarine group of the war.

Purpose

3. This Joint Concept Note (JCN) aims to act as a catalyst for a conceptually-led change to both the procurement, and the employment of, future maritime capabilities, particularly mine countermeasures, hydrographic and patrol ships; thereby ensuring that the Royal Navy maintains the balanced fleet that it requires.

'I am still the black swan of trespass on alien waters'[4]

Structure

4. Chapter 1 scopes the problem by exploring the impact of the future strategic maritime context on the 3 roles of maritime power: war-fighting, maritime security and international engagement, before examining its impact on what will constitute a balanced fleet for the UK in 2035. It will also look at the problem of achieving this balance under current plans. Chapter 2, guided by some perennial naval *truths,* offers a solution. Chapter 3, after taking a look at the future of unmanned systems, provides a detailed description of a solution, the future 'Black Swan' class sloop-of-war*,* its roles, tasks and possible systems that will operate off, and from, the platform.

Linkages

5. JCN 1/12 has evolved from the work into the development of the next edition of the *Future Maritime Operating Concept*, which will replace the 2007 version, and form part of the *Joint Operating Concept,* due 2013. Doctrinal

[4] McQueen H, *The Black Swans of Trespass: The Emergence of Modernist Painting in Australia 1918-1944*, Alternative Publishing, Sydney 1979.

guidance at the strategic level has come from Joint Doctrine Publication (JDP) 0-01 (4th Edition), *British Defence Doctrine* and JDP 0-10 *British Maritime Doctrine* as well as operational-level guidance from Allied Joint Publication 3.1, *Allied Joint Maritime Operations*. Advice and guidance on tactical level doctrine and concepts has come from the Maritime Warfare Centre and the Royal Navy's *Fighting Instructions*.

Acknowledgements

6. Many individuals from military organisations and academic bodies have contributed a great deal to the development of this *Joint Concept Note*. The author would like to thank all of those who have assisted him in the production of this publication. Particular thanks must be given to Richard Braithwaite and Tim Plant who designed the sloop-of-war, Dr Alistair Greig from University College London and Dr Tim Benbow from the Corbett Centre of King's College London, both of whom have provided much academic rigour.

Captain J A P White Royal Navy

FUTURE ‘BLACK SWAN’ CLASS SLOOP-OF-WAR: A GROUP SYSTEM

CONTENTS

CHAPTER 1 – THE PROBLEM: HOW TO MAINTAIN A BALANCED FLEET OUT TO 2035

'A Royal Navy locked into a cycle of ever smaller numbers of ever more expensive ships. Mr Speaker, we can not go on like this.'

The Rt Hon David Cameron 2010[1]

101. Looking out to 2035, *Future 'Black Swan' class sloop-of-war,* a group system, explores a possible solution to a problem that navies have always faced: how, facing an unpredictable future, does a fleet ensure that it has the correct balance – in both the quality and quantity of equipment and personnel – to deliver the required level of maritime power[2] demanded by the state? Importantly, the balance must have warfighting at its core.[3] Rather than looking at all 4 of the Royal Navy's fighting arms,[4] this Joint Concept Note (JCN) **only** focuses on how to deliver the units of power required by those surface assets[5] tasked with the protection of Sea Lines of Communication (SLOC) and sea control. This concept is not about more corvettes and fewer frigates. Neither is it simplistically about a high/low mix, or quantity versus quality, although it offers all of them. Rather, it is a concept that presents a view on how the surface fleet should be constructed to deliver the required military capability, or power, which will be demanded of the Royal Navy in the future. While there is some read across to other naval capabilities they are not discussed.

102. This Joint Concept Note aims to act as a catalyst for a conceptually-led change to both the procurement, and the employment of, future maritime capabilities, particularly mine countermeasures, hydrographic and patrol ships; thereby ensuring that the Royal Navy maintains the balanced fleet that it requires.

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[1] Prime Minister David Cameron's statement to the House of Commons on the *Strategic Defence and Security Review*, Tuesday 19 October 2010**,** http://www.number10.gov.uk/news/sdsr/.

[2] '*The ability to project power at sea and from the sea to influence the behaviour of people or the course of events'.* Joint Doctrine Publication (JDP), 0-10, *British Maritime Doctrine*, page V.

[3] '*The ability to conduct warfighting under-writes the ability to deliver maritime security and international engagement and this role has primacy*'. JDP 0-10, paragraph 215.

[4] The Submarine Service, Surface Flotilla, Fleet Air Arm and Royal Marines.

[5] This would include frigates, destroyers, mine countermeasures vessels, hydrographic and oceanographic vessels, patrol vessels, and their complementary assets and capabilities.

THE FUTURE STRATEGIC MARITIME CONTEXT

103. When analysing the future operating environment within which the Royal Navy will be required to deliver a balanced fleet, the best way to predict the future would be to create it – but this is an impossible goal. It is simply not known when, where, and with whom, the UK will be required to fight; it is just known that the UK will need to fight.[6] This uncomfortable conclusion means that the UK cannot shy away from the challenge of readying itself for future conflicts. Therefore, while the future cannot be predicted precisely, uncertainty can, and must, be reduced by obtaining and analysing the right information (including historical evidence) to help understand what the future is likely to hold. Hopefully, this will mean that the fleet is never too far from what is required. Before looking at what could constitute a balanced fleet for the UK in 2035, and the problem of maintaining one, the first part of this chapter will explore a possible future maritime operating environment. It will do so, using Joint Doctrine Publication 0-10, *British Maritime Doctrine* as a guide, by looking at the enduring nature and changing character of the future strategic maritime context and their impact on the roles of maritime power. This approach will enable deductions to be based as much upon an understanding of what will remain the same, as well as what will change. This ensures that maritime forces[7] are built to face probable continuities first, before being shaped by possible changes.

104. **Enduring Nature**. The government has stated that as a maritime nation the UK will retain significant global interests[8] with its prosperity, stability and security largely dependent upon the unique access provided by the sea and the maintenance of an international system of law and free trade.[9] The ocean, supported by the cyber domain and by air travel, will continue to be a key enabler for globalisation, which in turn, is and will remain fundamental to the UK's future.[10] In support of the UK's interests, British maritime power[11] will need to remain globally deployed to help guarantee the freedom of the seas, largely free from the constraints of host-nation

[6] In the period from 1946 to 2008, the UK has been involved in 22 state-based conflicts, second only to France on 25, which equates to 91 conflict years, the fifth most in the world. Human Security Report 209/2010, *The Causes of Peace and The Shrinking Costs of War,* Simon Fraser University, Canada, Oxford University Press 2011, pages 165–166.
[7] Throughout maritime forces are those systems, platforms and vehicles, together with their associated personnel, that are attributed, trained and certified to operate in the maritime environment.
[8] *A Strong Britain in an Age of Uncertainty*: National Security Strategy (NSS) Cm 7953, October 2010, page 4.
[9] *Ibid*., page 3.
[10] *Ibid*., page 4.
[11] '*The ability to project power at sea and from the sea to influence the behaviour of people or the course of events*'. JDP 0-10, page v.

support or the need for access, basing and overflight permissions from other countries. Sovereign bases, either afloat or ashore, will remain crucial to enabling freedom of political action.[12] The ability to continue to provide a significant contribution to protecting and promoting UK national interests at home and across the world, at sea and from the sea, on land and in the air, at all scales of effort and up to the highest intensity, will continue to require a balanced maritime force with warfighting at its core. The force will need to be appropriately structured, trained and resourced, and agile enough to take advantage of technological advances that will be too fast for current procurement and platform upgrade cycles. This will require maritime capabilities that are either built to adapt or cheap to replace.

105. **Future Character**. Out to 2035, an increasingly interdependent world will be characterised by intense globalisation and competition. While it will favour many, it will also alienate others. Alongside this, tensions and rivalries between states and a variety of trans-national pressures, some of which will be precipitated by climate change will remain. The future character of the maritime environment will be dominated by littoral[13] complexity and oceanic competition:

a. **Littoral Complexity**. By 2020, over 80% of the world's population will live within 100 miles of the sea. At present 147 (over 75%) of member states of the UN, are coastal states. Most of these states have extended their jurisdiction out to sea, in many cases as far as 200 nautical miles or more. Most human maritime activity – shipping, fishing, hydrocarbon exploration etc – is currently conducted within a 300-mile zone. This means that a substantial proportion of the world's economic and political activity is being conducted in a narrow strip of land and sea (the littoral) on average no wider than 300 miles. Not only will the littoral be threatened by the consequences of climate change, it will also face the effects of extreme weather and other natural events, all of which will have a negative impact on these heavily populated littoral regions.

[12] To guarantee non-complicity in acts that may otherwise contravene international law, any offensive action launched by a state from another state requires the host's endorsement – this does not apply on the high seas.
[13] '*Those land areas (and their adjacent sea and associated air space) that are predominantly susceptible to engagement and influence from the sea*.' JDP 0-10, page 1-6.

b. **Oceanic Competition**. The high seas, the deep ocean and the polar regions, as well as the airspace above, will become areas of increased competition as advanced technology, greater accessibility and growing resource pressures encourage more intensive exploitation by states and commercial interests. Competition will centre on fishing, deep sea mining and the extraction of oil and gas, and will extend to transportation and rights of passage. Such competition may, in parallel, give rise to security challenges and will become a constant sources of environmental and humanitarian concern about pollution.

106. **Future Conflict**. A high proportion of future tensions and conflicts will occur inside, or adjacent to, zones of maritime influence. While the UK is currently free from the threat of invasion, this is not the case for the sovereignty of some of the 14 Overseas Territories (of which 12 are islands), with a combined exclusive economic zone of 2.6 million square miles, the 5th largest in the world, they could well be subject to territorial claims by other states.[14] Also, the ever greater number of UK nationals living overseas,[15] together with national interests that continue to be under-pinned by a firm commitment to human rights, justice and the rule of law,[16] mean that the UK will remain engaged with the world. Such wide-ranging national interests in an unstable world that is increasingly susceptible to conflict make the UK both vulnerable and sensitive to events across the globe. Consequently, British military power is likely to remain heavily committed to operations overseas, a significant proportion of which are either in the maritime environment or may be decisively influenced by maritime forces.

107. **Political Objectives**. Protecting and promoting the UK's vital interests, including domestic security, cannot be separated from the security and stability of the wider international system.[17] The UK will therefore '*continue to play an active and engaged role in shaping global change*'.[18] International problems usually require international solutions, although the UK will be required to maintain the ability to act independently if necessary. As the world balance of power shifts to a multi-polar construct with the rise of powers such as China, India and Brazil, the UK will continue to: maintain its

[14] DCDC Global Strategic Trends Programme, *Future Character of Conflict,* pages 7 and 25.
[15] *Op. Cit*., NSS, estimated at 5.5 million, almost 10% of the population, page 2.5.
[16] *Ibid*., page 0.9.
[17] *Securing Britain in an Age of Uncertainty: The Strategic Defence and Security Review* (SDSR), page 2.10.
[18] *Op. Cit*., NSS page 2.1.

close relationship with the US; rely on NATO; and develop a leading role in Europe. Working with emerging states, it will also seek to counter global inter- and intra-state conflict at source. With no shrinkage in strategic ends – '*a secure and resilient UK, able to shape a stable world*'[19] – the maritime environment will remain critical for British policy.

THE FUTURE ROLES OF MARITIME POWER[20]

'Ultimately, the role of British maritime forces is to conduct war-fighting in support of national objectives…The ability to conduct war-fighting under-writes the ability to deliver maritime security and international engagement and this role has primacy.'[21]

108. A description of the maritime environment,[22] much of which will endure, is provided in Chapter 1 of JDP 0-10, *British Maritime Doctrine*, with Chapter 2 exploring the roles of maritime power. This section confines itself to looking at how the future strategic maritime context will impact on the 3 roles of British maritime power – warfighting, maritime security and international engagement – that will continue to deliver effect across the full spectrum of military tasks, at sea and from the sea.

Warfighting

109. **Nature**. Warfighting will continue to be the capability head mark, with the Royal Navy existing primarily to engage in combat with sea control[23] the pivotal enabler. '*As an island nation, for all but the most limited of operations, the UK must use the sea to deploy, operate, sustain and then recover her armed forces wherever they are required*'.[24] This requires sea control, which is, and will remain, the principal requirement for the Royal Navy. In order to support the primary focus of the *National Security Strategy* – the prevention of conflict – and to be able to gain the prerequisite level of sea control, warfighting must remain the benchmark. It is both the credible threat and

[19] *Ibid.,* paragraph 2.1.
[20] For a more detailed description of the roles of maritime power see JDP 0-10, Chapter 2.
[21] JDP 0-10, page 2-9.
[22] The physical, economic, diplomatic, political, legal and military.
[23] Sea control is defined as: *the condition that exists when one has freedom of action within an area of the sea for one's own purpose for a period of time, and if necessary, deny its use to an opponent. Sea control includes the airspace above the surface and the water volume and seabed below*. JDP 0-01.1 (8th Edition), *UK Supplement to the NATO Terminology Database*.
[24] JDP 0-10, paragraph 219.

proven capabilities that underpin the essential military contribution to conflict prevention – including strategic and conventional deterrence – even if not ultimately applied. Warfighting may be used for a variety of reasons, but the physical protection of the territorial integrity of the UK and its overseas territories (national security in the most basic sense) is the irreducible minimum requirement. Although there has been no threat of invasion of the UK mainland for many years, this is not the case for some of the overseas territories. Furthermore, there is no reason to expect that the UK will stop engaging in crises and conflicts around the globe. At the tactical level naval warfare will remain a process of attrition with the crucial capability being the delivery of effective firepower first. This will continue to depend upon the ability of a maritime force to possess an understanding of the operating environment superior to that of its adversaries. While effective firepower is important, it is superior understanding and decision-making that will allow even an outgunned naval force to win.[25]

110. **Character**. Whomever the Royal Navy is called upon to fight, it will require the capability to achieve freedom of manoeuvre on, under, and above, the sea in littoral and open ocean areas. Some assets will be able to operate in, or project power across, both of these markedly different zones. Yet each also has distinct characteristics that require unique techniques and technologies to address the demands of both the physical nature of the environment and the character of the threat. A maritime force will be required to operate across the full range of these areas, possibly simultaneously, conducting different activities in each. However, common to the whole maritime environment will be the requirement to understand the operating area,[26] exposing its opportunities and addressing its threats and risks. At a tactical level, achieving this degree of understanding will require capabilities that are assured, dependable and at immediate notice, able to provide scouting as well as spotlight coverage to complement the floodlights of strategic – and operational – level capabilities.

a. **The Littoral**. With wide variations, littoral regions present diverse challenges to forces seeking to exploit access from the sea, or waterways. In particular, urbanised areas on the coast present

[25] For a detailed description of simultaneous attrition and its application in modern warfare, see *Fleet Tactics and Coastal Combat 2nd Edition*, Chapter 2, Captain Wayne P Hughes Junior, US Navy (Retired), US Naval Institute, Annapolis.

[26] Climate change will fundamentally impact on the maritime environment, meaning that meteorological forecasting and hydrographic data – that can only be gained by presence in regions of interest – will be crucial for operational success.

significant challenges for expeditionary forces. As every littoral situation will be different, detailed shaping operations will invariably be required since high intensity activity in shallow or confined waters in the face of even modest sea-denial or irregular threats are complex and heavily influenced by the local conditions. Importantly, local actors will have a particular knowledge of their own environment and how best to exploit it, especially when deploying sea denial and irregular options. This aspect will confer on them at least an initial advantage and, in some cases, the initiative against opponents who have an imperfect appreciation of local conditions. A consolidated environmental understanding prior to engagement will remain essential; in areas of known security risk or potential threat to UK interests, such environmental (and cultural) understanding will need to be built and sustained through regular deployments to associated regions. This requires the navy to be globally deployed, throughout the year, on operations in areas of national interest.

b. **Open Ocean**. Open-ocean operations pose a different set of challenges, although understanding the operating space is still essential. While sea denial and sea control are simpler in what is a less cluttered environment, the all-round threats make it more challenging, especially due to increasingly long-range anti-surface and anti-air missile systems. Some capabilities that can be used to achieve sea denial in shallow waters, and thereby lead an adversary along certain courses of action while preventing others, are not possible in deeper water; mining is a classic example. Certain aspects of threat reduction, particularly against more covert threats such as submarines, offer a more complex challenge in the open ocean and demand a suite of all-arms capabilities to address them.

111. **The Future Character of the Maritime Threat**. Potential opponents will have 3 broad choices: to attempt to match our capabilities through conventional conflict; to adopt an asymmetric approach seeking to achieve significant impact at acceptable cost and risk, which for some opponents will include a preparedness to sacrifice their own lives; or, perhaps most likely, a combination of both. By exploiting irregular, as well as conventional attack, opponents will seek to achieve surprise and destroy cohesion, thereby attempting to gain decisive advantage. At higher levels of intensity or

tension, sea denial or monitoring capabilities will allow regimes and states to oppose access by expeditionary forces or simply to enforce claims to jurisdiction over Exclusive Economic Zones or resources in international waters. At all levels, anti-access weapons such as mines, unmanned systems, swarm tactics and improvised explosive devices may be readily employed. As well as more widely employable traditional threats, maritime forces will also need to be ready to deal with emerging threats from: directed energy weapons, electromagnetic pulse, more sophisticated forms of electronic warfare, cyber warfare and precision physical attack. Chemical, biological, radiological and nuclear weapons will continue to pose a threat. With no safe havens for maritime forces, while operating environments will remain distinct, they will be increasingly interconnected and interdependent, meaning that the ability to obtain sea control will increasingly rely on a substantial level of control of land, air, space and the cyber domain. Going beyond joint will not be a choice, which is why the Royal Navy must remain inherently *joint* in design and in control of the environmental seams.[27]

International Engagement

112. **Nature**. International obligations, as well as national policy, will continue to require British maritime forces to contribute to the preservation of international peace and economic growth, and provide a military commitment to confront actual and emerging crises. Under a UN mandate, the UK may be required to intervene to support a fragile or failed state. Where the environment is non-permissive, the main military task will be to create the security conditions that allow development and governance measures to be implemented. This may mean that maritime forces are required to deliver development activities directly.[28]

113. **Character**. Although most security sector reform has hitherto been land-based, British maritime forces, either independently or as part of a coalition, will increasingly play a key role in achieving success. This will be especially important in states where an enduring land-based stabilisation operation, with mass in the form of UK ‘boots on the ground’, risks destabilising the state further, or in cases where the political will for such a British commitment is lacking. The use of maritime capabilities to conduct

[27] For a detailed description of maritime operations and its need to control the air, sea and land interfaces, see JDP 0-10.
[28] This activity is primarily the remit of non-military organisations, including other government departments, non-governmental organisations, industry and business.

security sector reform allows a low footprint, high return for the UK despite a limited footprint.[29] Such an approach can deliver desired political intent with lower risk of entanglement, especially when mass is not immediately available or is politically undesirable.

Maritime Security

114. **Nature**. Increasing global security challenges, such as proliferation of piracy and resource exploitation, mean that maritime security will remain a high priority for the UK. The tasks associated with maritime security fall into 2 interrelated categories: Firstly, UK maritime security, which is focused purely on the UK mainland and overseas territories, and secondly, maritime protection, which is focused on physical protection and availability of an internationally recognised maritime infrastructure. While usually separated in time and space, they will remain, to a significant degree, interdependent and support the other 2 roles of maritime power. Both will continue to require inter-agency and international co-operation as well as the exploitation of a wide range of sources to increase understanding. The attributes of maritime power[30] mean that maritime assets will continue to play a major role in support of international and national authorities. Additionally, maritime security relies on a committed and dependable level of presence, visibility, assurance and credibility. These are required not only to defend the UK homeland and sovereign territories – at range where necessary – but also to preserve the free and safe use of the high seas. This ability is underpinned by the enforcement of a rules-based international system at sea, which protects UK and allied forces in oceanic and littoral areas. This enduring requirement requires a presence that can only be achieved by a forward deployed navy, in sufficient numbers, that is ready to deliver strategic effects on behalf of the UK.[31]

[29] '*UK combat forces, primarily based in the southern city of Basra, withdrew from Iraq in July 2009, but, until Aug 2011, at the request of the Iraqi Government, the Royal Navy has continued to train the Iraqi Navy to defend its territorial waters and offshore oil infrastructure*.' http://www.mod.uk/DefenceInternet/DefenceNews/DefencePolicyAndBusiness/OperationsInIraqFinishWithCompletionOfRoyalNavyTrainingMission. htm accessed November 2011.

[30] JDP 0-10, pages 2-1 to 2-7, dated September 2011.

[31] For example, the contribution of US and partner forces to relieve the distress caused by the catastrophic Pacific tsunami of December 2004, reversed the perceptions of America held by many Indonesians. '*Perhaps no other mission performed by the Joint Force provides so much benefit to the interests of the United States at so little cost*'. *Joint Operating Environment Report 2010*, US Joint Forces Command, page 33. accessed Jul 11.

115. **Character**. Fuelled by the industrial revolution, western trading nations have been instrumental in securing the use of the sea for centuries, with the British Empire facilitating today's globalised world. However, the dramatic reduction in quantitative terms of western naval capabilities over the last 2 decades is forecast to continue. This is especially true for the classes of relatively inexpensive ships that are needed to maintain a continuous naval presence in areas of national strategic interest. Therefore, unless the UK can find additional numbers, its security and prosperity will have to depend ever more upon the goodwill of a large number of non-aligned states and non-traditional partners. It will be entirely up to other states to uphold the international system of law and free trade that is so vital to the UK. While regional security regimes are a force multiplier for world order and a template for trans-national engagement, unless states are involved, they will have no voice. Within these regional regimes, diplomatic disagreement or friction between states will not prevent them co-operating on maritime security issues.[32] Maritime forces are strategic tools providing political influence. They allow governments to co-operate covertly or overtly at their discretion, with limited risk of compromise by public scrutiny or media focus. However, unless the UK has enough units to engage with foreign partners at sea, it will be left shouting from the terraces in an attempt to influence other powers to protect vital British maritime interests. '*Will other countries be willing to shoulder the responsibilities which we have abdicated? And are the other powers which will step into our place likely to make the world a better place than we would seek to do*?'[33]

Key Deductions

116. Sea control will remain the principal requirement for the Royal Navy and underpins its very being. As long as the UK has global interests, sea control will remain an essential prerequisite for the projection of British military power, even when an operation is inland. While many platform-based threats faced in the future will be developments of what is available today, it is their lethality, ease of use, and cut-price availability, which will change the character of maritime warfare. Such readily deployable anti-access weapons will require the Royal Navy to remain globally deployed, acclimatising itself in

[32] The international anti-piracy operation off Somalia is but one example, which sees NATO nations, alongside Japan, China and Russia, to name but a few, conducting maritime security operations in support of a common aim.
[33] Bob Ainsworth MP, writing the forward to, *The Tipping Point: British National Strategy and the UK's Future World Role*, by Bernard Jenkin MP and George Grant, www.henryjacksonsociety.org, July 2011.

likely regions of tension. Often starting from a point of disadvantage, maritime forces will need to acquire the necessary level of sea control – often in an adversary's littoral – where seizing back the initiative will be the first task. In conflict, this requires a fleet with sufficient quantity to enable a global understanding of areas of likely tension, with the resilience, in numbers, to withstand losses; and also the quality, in all the components of fighting power, to gain the required level of sea control. In operations other than war, this global presence will provide the numbers required to fulfil the maritime security tasks demanded by a maritime nation as well as the strategic significance required in the maritime environment to engage with the international community. In order to meet these future challenges the Royal Navy requires an agile culture, one that embraces change, and must be *a thinking* navy that is able to adjust the balance of the fleet correctly.

WHAT CONSTITUTES A BALANCED FLEET FOR THE UK?

> *'Over the next decade, maintaining the Navy's war-fighting edge and addressing fiscal constraints will require significant changes in how we develop the force. We will need to shift from a focus on platforms to instead focus on what the platform carries*.'[34]
>
> Admiral J Greenert

117. With war-fighting as the capability head mark for the Royal Navy, the primary balance needs to be found within its warfighting role. Any resource spent on assets that are unfit for war is a waste, as is dedicating excessive resource to assets tasked with sea control. For the UK, a balanced fleet is one that is focused on delivering the 4 non-discretionary Military Tasks,[35] which demands a sovereign warfighting capability[36] with the means to conduct independent expeditionary operations at range, in a hostile environment. This requires the Royal Navy to:

a. Maintain a complete suite of maritime warfare capabilities.

[34] Greenert J Admiral, *Navy, 2025: Forward Warfighters,* US Naval Institute Proceedings, dated 18 December 2011, page 21.
[35] Military Task 1: providing strategic intelligence; Military Task 2: providing nuclear deterrence; Military Task 3: defence of the United Kingdom and overseas territories; Military Task 4: support to the civil emergency organisations in times of crisis. *Interim Defence Strategic Guidance,* dated 12 May 11.
[36] '*We will maintain our ability to act alone where we cannot expect others to help*.' *Op. Cit., Securing Britain in an Age of Uncertainty: The Strategic Defence and Security Review*.

b. Continue to provide and support the nation's strategic deterrent.

c. Be able to protect those SLOC that are vital to the UK.

d. Provide the backbone of the UK expeditionary capability by maintaining a maritime task force of naval air, surface, sub-surface, amphibious and associated joint assets that are capable of operating in the open ocean and gaining access to a contested littoral.

e. Be able to deliver, sustain and recover the required level of land effect,[37] some, or all, of which could be delivered from the sea. This could range from an amphibious brigade to a precision strike from an air, surface or sub-surface maritime asset.

In meeting these tasks, the fleet must take account of technological advances and financial limitations, as well as both the enduring nature and changing character of the maritime environment. This will require greater emphasis on the conceptual component of fighting power, while remembering that the enemy always has a vote.

A Balanced Surface Fleet – What's Wrong With Large Multi-purpose Ships?

118. **Resource**. Without a shock event, or a major military challenge, the defence resources available to provide a balanced fleet will, at best, remain constant. When married to the assumption that the rising costs of fighting power ensure that platform costs must go up, meaning overall numbers must go down, this reality makes funding a balanced fleet impossible. This is not just a UK problem: *'prices of US military ships and fixed-wing aircraft are now so high that they are outstripping the ability of the military services to pay them*'.[38] If this trend is not checked, how many platforms will the UK be able to afford in 2035?[39] While increasing platform costs are almost certain if the armed forces continue to procure bigger versions of legacy platforms, the assumption that this investment results in increased quality is unsound.

[37] For a description of maritime power projection see JDP 0-10, paragraph 231.
[38] http://www.rand.org/publications/randreview/issues/spring2009/cost3.html accessed 9 January 2012.
[39] As Norman Augustine, an aerospace industry executive, stated in his famous forecast of 1986 in reference to the soaring prices: '*In the year 2054, the entire defence budget will purchase just one aircraft. This aircraft will have to be shared by the Air Force and the Navy three and one half days each per week except for leap year, when it will be made available to the Marines for the extra day*.' His dire prediction of vanishing aircraft inventories equally applies to ships.

119. **Quality**. For the surface fleet tasked with protecting SLOC and gaining sea control, set against the future operating environment and maritime roles, current procurement strategies will fail to deliver a balance in terms of either quality or quantity. There is no doubt that the current and future surface combatants will be capable of conducting a wide range of tasks across the full spectrum of maritime operations. However, these large combatants will be too few, too costly, too mission essential and most importantly too vulnerable to be risked in a contested littoral – although without an alternative they will have to be risked with the knowledge that they will probably take losses. Defence needs to escape its current predicament of escalating platform and personnel costs causing ever decreasing numbers, which also lack the quality required to make them fit for task. If this issue is not tackled, Defence will be unable to fulfil its important peacetime roles of international engagement and maritime security, while in war it will not have the quality required to assure access, thereby severely restricting the expeditionary capability of the British Armed Forces. Quite independent of its impact on numbers, concentrating capability in large platforms no longer delivers the necessary capability; 'quality' is not achieved, while 'quantity' is jeopardised.

120. **Quantity**. While perceptive, dynamic and motivated people are critical, a balanced fleet also demands the right number of credible and capable units of power to deliver the tasks required of maritime forces. The drive for increased quality demands continued investment in all the components of fighting power; however, this should not be at the expense of quantity, which having both a quality and capability all of its own also requires investment. '*The changing character of maritime warfare means that the Royal Navy will most likely find itself operating in a complex, congested environment involving disparate actors with very short warning and reaction times*'.[40] In this environment, UK Armed Forces may lack the political or military initiative to prevent an opponent striking first with enough firepower to have a significant strategic impact – including sunken ships. In many regions, the offensive firepower available to potential adversaries is already a real threat and it is only predicted to get more serious, both in lethality and proliferation. Attempting to offset this risk with more sophisticated defensive firepower or more resilient platforms carries obvious risks and escalating costs. Further, when viewed against technological advances in decision-

[40] 20111007-URBAN WARRIOR PVR-U-CMF dated 7 October 2011.

making and weapon systems that enable greater power to be placed in smaller assets, greater numbers will be a capability multiplier. This will be especially true for those assets tasked with gaining sea control in a contested littoral. In the future, until sea control has been assured to an acceptable level of risk, the contested littoral will remain no place for mission-essential units.

121. **History**. Fortunately, history provides some lessons, since maintaining a balanced fleet is not a new problem for the Royal Navy. At the beginning of the last century spending on warship construction appeared to be spiralling out of control with the cost of a battleship increasing from roughly £1.8 million in 1910 to £2.7 million in 1912. In addition, the burden of maintaining battleships in commission was hardly less onerous than that of building them. Each super-dreadnought required a crew of 1000 trained seamen. Moreover, whereas battleships could be built in 2/3 years, it took at least 6 years to train recruits to operate the highly sophisticated machinery with which they were fitted. For the cost of one battleship the Navy could have purchased 20 submarines, absorbing many fewer men, costing a lot less to maintain and, most importantly, offering a valuable and complementary military capability.[41] But this was not an either/or, as the battleship had an essential role; instead it is about finding the right balance between different units of maritime power. In 1912, the right answer was not 4 more super-dreadnoughts but then neither was it 80 submarines; rather it was a balance. Within fiscal constraints, the decision on where the balance lies must be dependent upon an assessment of future threats, risks and vulnerabilities.

[41] *The Submarine Service 1900-1918,* edited by N Lambert Navy Records, Section 2001, pg xxvii.

SUMMARY

122. The UK needs affordable solutions to deliver a balanced fleet. It requires the agility to adjust to an uncertain future where it is not known precisely, who, where and when, it will be required to fight. It only knows that history has shown that it *will* be required to fight. Defence, therefore, needs an intellectual and physical agility that is able to deliver this fleet, fit for task. If not, the Navy risks slipping into terminal decline unable to protect the UK's vital interests.

123. Further, after investigating some perennial naval truths – the limiting danger lines – Chapter 2 explores the future 'Black Swan' class sloop-of-war concept. Drawing on the key deductions from this Chapter, it offers a solution to the problem of maintaining a balanced surface fleet with warfighting at its core.

CHAPTER 2 – A SOLUTION: THE FUTURE 'BLACK SWAN' CLASS SLOOP-OF-WAR

'Following our experience in Iraq and continuing commitment to Afghanistan, few would have predicted that British air and maritime power would be employed under a NATO banner to enforce a UN sanctioned no fly zone and cease fire in order to protect lives along the North African littoral…. The unstable and unexpected have remained the norm. Therefore we must continue to deal with such uncertainty, accept ambiguity and adapt accordingly to meet future challenges. Recognition that we cannot predict the future should remind us that uncertainty should inform the basis of both our organisation and strategic thinking.'[1]

201. **Introduction**. The inability to forecast the future requires navies to be built to face the enduring nature of the maritime environment first, before being shaped by its changing character. This requires navies to be guided by their enduring philosophy and principles: doctrine. It is doctrine that provides the pilot when navigating the uncharted waters of the future. This chapter will investigate some perennial naval truths, the limiting danger lines, before drawing on the key deductions from Chapter 1 to offer a possible approach to deliver the units of power required by those surface assets tasked with the protection of SLOCs and sea control, thereby providing an affordable solution by which the UK can maintain a balanced surface fleet out to 2035, with warfighting at its core.

NAVAL TRUTHS

202. **The Seat of Purpose is on the Land**. For British maritime power, the real focus of maritime strategy is on what you do once you have control of the sea; '*the essence of maritime power is the ability to influence events on land*'.[2] This means that while sea control is essential, only the minimum level of effort, commensurate with the acceptable level of risk, should be employed in it. The rest of our resources should be used to influence events on land, both at, and from, the sea. This also requires sea control, of course, which enables the holder to use maritime power and, if required, denies an

[1] MOD, *Enhancing Strategic Capability Study, Final Report (Revised)*, 25 August 2011, paragraph 2.2.
[2] Joint Doctrine Publication (JDP) 0-10, *British Maritime Doctrine*, paragraph 227.

opponent that same ability. At sea, the military, diplomatic and economic impact will depend upon the opponent's dependence upon the maritime environment for its security and resilience; for many states sea dependency is growing. On land, the military, diplomatic and economic impact will depend upon the holder's ability to influence its opponent from the sea; this influence could take a variety of forms from a low-level focused maritime blockade (such as one focused on components for weapons of mass destruction), to an invasion of the opponent's territory.

203. **Technology is Vital, but…** '*Doctrine is the glue of tactics and to know tactics know technology*'.[3] In naval warfare, technology drives tactics but concepts and then doctrine decide how that technology should be applied to deliver the required effect. Shaped by the enduring nature of maritime power, the size, shape, means of movement and medium in which a maritime asset moves are only important to the extent that they allow it to cope with the changing character of maritime warfare. Until it becomes impossible to exercise sea control, British maritime power will continue to exist and its influence will be measured by the extent to which the capabilities, rather than the ships in themselves are able to make that control effective.

204. **People Matter Most**. People provide the edge and matter most, both ashore in acquiring the capability and afloat in applying it. This requires the future navy, to be an educated institution, imbedded with the enduring nature of maritime power (its history), constructed to meet the challenges of today and yet with a realisation that this will not be what is required in the future.

205. **Change is the Steady State of Navies**. The role of the conceptual component is to ensure that the thinking navy continues to explore new ways to meet emerging threats and challenges. This is the nature of the maritime business. It means that if the Royal Navy is right for today, it may not be right for tomorrow. The role of concepts is to ensure that this gap is never too large, so that a thinking navy is always able to reconstitute itself and its skills in time of need. Retaining this ability to bridge the gap requires maritime assets to be agile enough to adapt to the changing character of maritime warfare within a relatively short timescale. However, with procurement

[3] Hughes W.P Jr, Captain, US Navy (Retired), *Fleet Tactics and Coastal Combat 2nd Edition*, US Naval Institute, Annapolis, Maryland, page 174.

timescales stretching into decades, and the life spans of platforms being 30 plus years or more, this adaptability must be found primarily within the people and systems which operate in, and from, the platform.

206. **Evolution Rather than Revolution in Maritime Affairs**. As the Royal Navy is always in contact, its response to technological change has always demanded an evolution, rather than revolution, in maritime affairs. As one of the major tasks of the Royal Navy is '*to exert power and influence in support of national political objectives with the aim to prevent conflict by deterring, coercing, stabilising and reassuring others in time of crisis*',[4] the audience needs to believe in that power. It is this interpretation that prevents conflict. A maritime power, such as the UK, would not wish to risk a revolutionary change in its means of applying that power being misinterpreted as a marked reduction in its warfighting capability and/or credibility. Therefore, any change not only needs to deliver improved capability but also requires a clear articulation of its credibility in order to support the primary objective of maritime power: to prevent conflict.

207. **Naval Warfare is Attritional**. Tactically, at sea, naval warfare centres on the process of attrition which comes from the successful delivery of firepower. Therefore, whoever fires first has the advantage, even if outgunned. The ability to fire first requires superior decision-making (which depends upon information superiority and effective command and control), tactical control of the engagement envelope (the ability to find, fix and strike before the opponent can find you) and a weapon system that works. This does not mean that the manoeuvrist approach has no place in naval warfare, but, rather like in air warfare, it means that the first targets need to be those which have the greatest ability to restrict your freedom of manoeuvre.

Conclusion

208. In the future maritime operating environment, gaining sea control will require maritime assets with agility (built to adapt), superior decision-making, tactical control of the engagement envelope at a greater range, and enough numbers to withstand inevitable losses. In the contested littoral, until sea

[4] JDP 0-10, page 2-21.

control has been assured to an acceptable level of risk it will remain no place for mission essential units.

A POSSIBLE SOLUTION

209. **Introduction**. This possible solution only looks at those surface assets, or units of power[5] which are primarily tasked with achieving sea control; these assets will form a coherent whole with other maritime platforms more oriented to exploiting sea control. The solution is not about more corvettes and fewer frigates. Neither is it simplistically about a high/low mix or quantity versus quality, although it offers all of these. Rather, it is about the perpetual problem of keeping pace with the changing character of maritime warfare in order to ensure that the Royal Navy is fit for task now and in the future.

210. **Systems Not Platforms**. Much as torpedoes, submarines and aircraft changed the face of maritime warfare in the last century, unmanned systems will do the same in the 21st Century. In the future, unmanned systems could help to provide a solution to maintaining a balanced fleet by matching the required capability to future threats, available resources and mandated tasks. This future concept would concentrate investment in systems, rather than the ship, and a change in emphasis to one that does not see the ship as the fighting platform. This concept has no place within the current rigid force structures, which tends to see capability largely in terms of platforms. Instead, capability would be delivered by deployed systems from multiple sloops-of-war, much as they did extremely successfully in World War II. At less cost and less risk – it only takes one torpedo to sink a ship – 4 or more of the future sloops-of-war deployed systems, when combined, would deliver more capability than a single, large mission-essential multi-role platform.

The Ship

211. The future sloop-of-war will be more akin to an aircraft carrier, or an amphibious ship (albeit on a much smaller and less sophisticated scale), providing command, hotel services, maintenance facilities and a taxi service

[5] This would include frigates, destroyers, mine countermeasures vessels, hydrographic and oceanographic vessels, and patrol vessels.

for a range of unmanned and manned systems. These systems would be deployed in the form of a range of capability packages that can be added to the ship to meet its required tasks. For example, a sloop-of-war tasked with conducting Atlantic Patrol Task North[6] would have capability packages for maritime intelligence, surveillance and reconnaissance, counter-drugs, and humanitarian and disaster relief. In this case the systems carried would be a mix of manned and unmanned. However, the ship tasked with mine clearance in the Arabian Gulf may just have a basic maritime intelligence, surveillance, target acquisition and reconnaissance as well as mine clearance package, both of which would be unmanned. When conducting warfighting operations, the ships should be viewed as units of capability that come together to deliver the required effect across the warfighting spectrum. For example, the threat may be submarine-heavy requiring each ship to have an anti submarine warfare package along with a maritime intelligence, surveillance and reconnaissance package. While the surface (anti surface warfare) and air (anti air warfare) threat may only require one package of each shared between the group of ships. In this example, in the near term, all the find and fix tasks would be conducted by unmanned systems with strike being delivered either by organic manned helicopters, or long-range weapons fired from a ship. In the future, technology – if ethics allow – will enable unmanned systems to engage targets autonomously.[7]

212. Much as aircraft allow an aircraft carrier to remain at range from an engagement, so will unmanned systems for the future warship. This means that the investment needs to be in the weapon systems, manned or unmanned, rather than the ship. While crew survivability is important, money should not be wasted on the ship. Instead it should be designed along cheaper commercial lines. This reduction in individual costs (£65M per ship), albeit offset by the need to build more, offers the opportunity to increase platform numbers with no reduction in capability. Indeed the greater number of ships and unmanned systems offers significant potential to conduct most tasks more covertly and efficiently and reduce the risk to other assets and personnel. This concept thereby achieves ‘quality’ (in the ability to perform the range of assigned tasks) as well as greater ‘quantity’ (in the number of

[6] http://www.royalnavy.mod.uk/Operations/Enduring-Operations/Caribbean-Patrol.
[7] *Able to make decisions and act on them as a free and independent moral agent* – The Concise Oxford English Dictionary, 11th Edition.

hulls) to provide a more ubiquitous presence in maritime security and international engagement, and the ability to be risked in war-fighting.

213. As warfighting will be its core capability, the future warship must be relevant to future missions and complement those larger platforms tasked with delivering effect on land. In designing the ship detailed in Chapter 3, the following guidelines were followed:

Cost
The investment is in the external systems, both manned and unmanned and **not** the ship.
Four sloops-of-war plus capability packages equals the cost of one large multi-role platform.
While there is no requirement for the full range of capability packages to equal the number of ships, each ship must be capable of operating all available packages.
The ship must be able to change roles away from base support from, for example, fishery protection in the UK, to supporting Special Forces off Africa.
Ship
Size: 2,000 to 4,000 tonnes – the ship needs to be big enough to fly the White Ensign[8] and act as a visible presence across all 3 maritime roles.
Propulsion: diesel electric – though hopefully during the platform's life, technological advances will allow diesel to be replaced by an alternative energy source. Transit speed of 10 to 16 knots, operating speed below 6 knots and top speed of 18 to 24 knots; however, speed should be sacrificed in favour of reduced costs.
Port Facilities: no reliance on host-nation port facilities, such as tugs and water.

[8] The White Ensign or St George's Ensign is an ensign flown on Royal Navy ships. It consists of a red St George's Cross on a white field with the Union Flag in the upper canton.

Ship (Continued)
Endurance: unsupported 90 days (crew), min 30 days (fuel).
Performance: globally deployable, able to operate both in the marginal ice zone and in hot and humid conditions with minimum survivability characteristics. The unmanned systems, rather than the ship, should be capable of operating in areas of denied access.
Crew: a core crew of around 8[9] with accommodation for those additional personnel required for each module, plus basic dormitory style accommodation for a further 60.
Cyber: secure from cyber attack.
Internal Weapon Systems
Sensors: basic sensors to support navigational safety standards and self-protection weapon systems.
Weapons: a visible deterrent in the form of a gun; self-protection weapon systems such as small arms, directed energy weapons, lasers etc.
Mission Bay/Hangar: a mission bay to act as a hanger/repair facility for unmanned systems[10] (able to accommodate at least one medium and one small rotary wing unmanned air system).
Flight Deck: large enough to accommodate a Chinook-sized helicopter, with personnel access to rear ramp.
Mission Planning Room: a mission planning space for up to 30 people to plan and execute missions.
Communications: basic communications facilities supplemented by essential unmanned systems' mission support architecture; the major capability will be invested in the external systems.

[9] OF4/OF3 commanding officer depending on ships role. 8 is the minimum number required to operate the vessel at sea, but it will demand a change to current practices. For example, machinery spaces will need to be remotely monitored and the crew will have to do without chefs and stewards; although perhaps sous vide cooking, as demonstrated by Heston Blumenthal on HMS TURBULENT. **http://www.mirror.co.uk/celebs/news/2011/03/20/heston-blumenthal-s-slow-food-going-on-forces-menu-115875-23002217/**

[10] This is a generic term for all unmanned systems regardless of their environment.

Support to External Weapon Systems
Boats: the capacity to launch and recover 2 large Rigid Inflatable Boats.
Unmanned Systems: capacity to launch, operate[11] and recover.
Manned Helicopters: capacity to launch and recover.

Pros and Cons

214. The decision to change the emphasis from platforms to systems needs to be carefully considered; therefore, the concept has been rigorously tested by red teaming. The pros and cons identified during this process were:

Pros
The concept delivers a balanced surface fleet with war-fighting at its core that is able to deliver maritime power in support of political objectives.
Increased operational capability by providing numbers, conducting tasks more covertly and efficiently, and reducing the risk to other assets and personnel.
More platforms for maritime security and international engagement.
An agile procurement cycle focused on updating individual systems rather than whole platforms.
An affordable solution to ensure that capabilities are able to remain relevant to a future that cannot be predicted. The life of the ship is typically fixed at 30 years yet the rate of change of technology in installed systems means that the ship is either quickly outdated, or requires costly upgrades. Most of this ship's upgrades would be confined to the capability packages.
With technology residing primarily in the systems rather than the ship, the basic model version will be an attractive purchase for many less advanced navies; and the more ships that are built, the cheaper the overall unit cost becomes.

[11] This may be as a coordinator operating unmanned systems, including those from other platforms, or just a mission planner, with unmanned systems having mission command.

Pros (Continued)
Resilience of capabilities – there is no single point of failure; instead capabilities are delivered by a greater number of assets.
This concept is a necessary counter to the philosophy that even if it means fewer platforms, bigger is better.
It is at the crest of a wave of challenging the previous orthodoxy.
Will prevent the Royal Navy from going into terminal decline, unable to protect the UK's vital interests.
Cons
The concept is untested – as navies are always in contact and rely on credibility and capability to deter, any change needs to be evolutionary rather than revolutionary.
It goes against the universal tendency, both from allies and potential adversaries, to procure fewer, but bigger platforms.
Previous attempts to re-adjust the balance have failed due to an overriding conservatism that sees bigger, and hence more expensive, as better. Implementing the concept will require challenging ingrained thinking.
Loss of versatility – offset by increased presence and the ability to switch between roles?
Loss of resilience in the ship – true, but the investment will be in protecting the crew rather than the ship.
Risk of the uneducated still seeing the ship as the *capability* and therefore constraining the Naval Plan to platform numbers rather than capability.

SUMMARY

215. With naval truths providing the safe water and doctrine the pilot, this concept offers the surface fleet an operational capability that is agile enough to adapt to the changing character of maritime power. While acknowledging that this is an initial analysis for how the Royal Navy, within financial constraints, can maintain a balanced surface fleet with war-fighting at its core, overall the benefits far outweigh the risks. The need for a graduated change means that mine countermeasure, hydrographic and patrol ships should be the first capabilities to be replaced by the future 'Black Swan' class sloop-of-war, followed by frigates and destroyers. The requirement for a greater number of surface ships when warfighting will also have the added advantage of allowing the current gaps in maritime security and international engagement to be filled.

216. Having explored the problem and proposed a possible solution, Chapter 3 takes an unclassified look at the future of unmanned systems before providing a detailed description of the future 'Black Swan' class sloop-of-war. This description is expanded to discuss its roles, tasks and possible systems that will operate off, and from, the platform.

CHAPTER 3 – THE FUTURE

FUTURE 'BLACK SWAN' CLASS SLOOP-OF-WAR: ITS ROLES, TASKS AND POSSIBLE SYSTEMS

'It must be considered that there is nothing more difficult to carry out, nor more doubtful of success, nor more dangerous to handle, than to initiate a new order of things. For the reformer has enemies in all those who profit by the old order, and only lukewarm defenders in all those who would profit by the new order, this luke warmness arising partly from fear of their adversaries, who have the laws in their favour; and partly from the incredulity of mankind, who do not truly believe in anything new until they have had the actual experience of it'.

Niccolò Machiavelli 1513[1]

301. The first part of this Chapter takes an unclassified look at a roadmap for unmanned systems and their future roles. It then provides a detailed description of the future sloop-of-war, its roles, tasks and possible systems that will operate from the platform.

UNMANNED SYSTEMS[2]

Background

302. Unmanned systems already play a central role in modern warfare, and '*there is a real possibility that, after many false starts and broken promises, a technological tipping point is approaching that may well deliver a genuine revolution in military affairs*'.[3] This belief was reflected in the recent 2010 Strategic Defence and Security Review which stated that '*one of its principles was to invest in programmes that will provide flexibility and advanced capabilities, and reduce legacy capabilities which we are less likely to need in a world of precision weaponry, and where the battlespace increasingly*

[1] Niccolò Machiavelli, *The Prince and The Discourses,* The Modern Library, Random House, Inc., 1950, page 21.
[2] Unmanned Systems (UXS) include air (UAS), ground (UGS), maritime surface (USS) and subsurface (UUS) systems, and are defined as: *a system whose components include the unmanned platform and all equipment, network and personnel necessary to control the unmanned platform*. Joint Doctrine Note (JDN) 2/11, *The UK Approach to Unmanned Aircraft Systems*.
[3] *Ibid*., page iii.

involves unmanned and cyber operations'.[4] Therefore, much as torpedoes, submarines and aircraft changed the face of maritime warfare in the last century, unmanned systems offer the same in the 21st century. However, in order to understand their impact on the maritime environment, an appreciation of how unmanned systems will change the function of maritime assets, rather than how they will help the current model, is required. The correct question needs to be how will this advance undermine the current operational model? When looking at unmanned platforms it would be wrong to view them as a bolt-on to current capabilities. Instead they will radically change the form and function of maritime assets as they adhere to the changing character of maritime warfare.

303. In the absence of any higher level guidance[5] it is not the intent of this Joint Concept Note (JCN) to explore fully the UK approach to unmanned systems, although the recent Joint Doctrine Note (JDN) 2/11 on *The UK Approach to Unmanned Aircraft Systems* made an important start. Instead, using the United States, Department of Defense *FY2009–2034 and FY2011-2036 Unmanned Systems Integrated Roadmap* as guides, the intent is to provide a brief overview of what unmanned systems may deliver in the future. For the future sloop-of-war, the issue will be one of operational compatibility. It will be required to launch and recover the full range of possible unmanned vehicles whose size, shape and mode of operation are yet to be decided.

Advantages and Disadvantages

304. The advantages of unmanned systems mean that where there is no compelling requirement for manned platforms, unmanned platform solutions will be sought. This will particularly apply to those tasks that are *'dirty, dull, deep and dangerous*'.[6] Unmanned systems will also be sought in an attempt to provide greater operational capability at a reduced cost. However, it is important that these solutions are not taken in an ethical policy vacuum. '*The UK must quickly establish a clear policy on what will constitute acceptable machine behaviour in the future*';[7] although this policy will need to take into account that our future adversaries may be advancing a *Terminator* like future. Currently the major disadvantage of unmanned systems is their over

[4] *Securing Britain in an Age of Uncertainty*: The Strategic Defence and Security Review 2010, page 17.
[5] A UK MOD roadmap for unmanned air systems was produced in 2005.
[6] DCDC, *Future Maritime Operational Concept* 2007, dated 13 November 2007, page 1-15.
[7] JDN 2/11, page 5-11.

reliance on real-time, or near real-time, communications and satellites for navigation and time keeping. This makes them noisy and hungry for bandwidth – which may not be there – and vulnerable to both soft and hard kill. In the future, this technological gap will be closed allowing unmanned systems to be given mission command, within preset boundaries, either as automated[8] or autonomous systems. This will offer unmanned systems an even greater advantage over their manned counterparts, by giving them superior resilience, lethality and tempo of operation, while offering reduced infrastructure costs in both equipment and personnel. They will also enjoy greater situational awareness than their human commanders. So who, in the future, will political masters trust to make the right decision when machines do not get tired or emotional, or engage in violence fuelled by self gratification, anger or ill-found pride?

Unmanned Systems – The Future

305. Although unmanned systems will share many characteristics, their operating environments will demand greater emphasis on particular capabilities and hence a degree of specialisation. For example, vehicles which operate underground or underwater will require a greater level of automation than those which remain within line of sight. So while many of the anticipated advances will be shared across the environments, in some cases, this development will not be uniform, although all 3 will see a full range in size from nano to very large platforms, some may even be larger than current manned platforms. While the UK may place self-imposed constraints on how far it can adopt these enhanced capabilities, this will not be the case for potential adversaries. Consequently, these advances should be seen as both threats and opportunities, with anti-unmanned warfare becoming a vital warfare discipline, if it is not one already. The unmanned systems integrated roadmap is illustrated in Figures 3.1 to 3.3.

[8] Terms and definitions are in accordance with JDN 2/11, Lexicon.

	2009 *Evolutionary Adaptation*	2015 *Revolutionary Adaptation*	2034
Commands	Physical Human Machine Interfaces	Scripted Voice Command/Hand Signels	Natural Language Understanding
Collaboration	Individual System	Teaming w/in Domain Collaboration Across Domains	Teamed Collaboration
Frequency	Constrained RF	Frequency Hopping	Multi-frequency Communcation
Mission Complexity	Operator Controlled		Autonomous Adaptive Tactical Behaviors
Environmental Capability	Limited Environmental Difficulty	Expanding Environmental Difficulty	All-Weather Environment Difficulty
Product Line	Mission Package Product Line Dependent		Product Line Independent
OPSEC	Signature High		Signature Low
Operational Control	1 Operator / Platform	1 Operator / Domain	1 Operator / Team
Bandwidth	Limited	Advanced Bandwidth Management	Autonomous Bandwidth
Mission Endurance	Hours	Days Months	Years
Maintenance	Operator		Automated
Awareness	Sensor Data	Situational Awareness	Actionable Information

Figure 3.1 – Performance Envelope Common to All Environments[9]

306. **Air**. Unmanned air systems are evolving into 'multi-role platforms able to provide intelligence, surveillance and reconnaissance 'persistent stare' at targets over a large area and quick reaction strike at targets of opportunity'.[10] Providing situational understanding to the force, and for themselves, they will be able to find, fix and strike, either under the concept of mission command, or provide support as requested or directed, by other unmanned systems or human commanders. Key performance requirements for future air systems, depending on mission requirements, will be: speed, large payloads, endurance, network-enabled capability, independent navigation, ability to conduct collision and terrain avoidance, and ability to remain undetected through a combination of stealth and use of cover.

[9] *FY2009–2034 Unmanned Systems Integrated Roadmap*, USA DoD, dated 6 April 2009, page 27.
[10] *Ibid*., page 28.

	2009 *Evolutionary Adaptation* 2015 *Revolutionary Adaptation* 2034		
Dependency	Man Dependent SA/ Off Board SA	Sense and Avoid	Fully Autonomous/ On Board SA
Speed	Subsonic	Transonic	Super/Hypersonic
Stealth	Signature High		Signature Low
Maneuverability	1 'G'	9 'G'	40 'G'
Self Protection	Threat Detection	Threat Jamming and Expendables	
Sensor Ranges	Current	25% Extended	50% Extended
Icing	Visual Meteorological Conditions - Light	Moderate	Severe
Turbulence	Light	Moderate	Severe
Precipitation	Light	Moderate	Severe

Figure 3.2 – Air Performance Envelope[11]

307. **Maritime Surface**. While not as complex as the ground environment, the surface of the sea does present some unique challenges such as varying sea states that can have a catastrophic impact on performance, a wide range of temperatures and salinities, and internationally recognised rules for collision avoidance. While surface systems will undoubtedly be required to keep out of the way of manned ships, what will be the rules for unmanned ship versus unmanned ship? The tasks assigned to a unmanned surface systems will be as wide-ranging as those currently performed by manned warships. As such, it will require the ability to deploy, perhaps sustain, and then recover, its own set of unmanned platforms. This will require highly sophisticated organic sensors and the ability to execute mission command, which will include an independent navigation and mission-planning capability. The need for independence will be driven by the requirement to operate over-the-horizon and perhaps beyond the range of available communication systems. This will also reduce the reliance of the unmanned system on fragile, and time consuming, communication relays.

[11] *Ibid*., page 30.

308. **Maritime Underwater**. The challenges associated with communicating underwater mean that unless they remain tethered,[12] in order to be effective they will be required to operate without real- or near-time control. When combined with the range limitations of acoustic and optical communications, un-tethered systems will need at least a basic level of automation. For some tasks, such as data gathering, this level of automation will be relatively low, with little need for communications during the mission and with data transfer occurring after recovery. Underwater operation poses many of the challenges faced in the air and on the surface. In a 3-dimensional space, underwater vehicles will be required to float, move and fight without recourse to off-board sensors. They will be required to operate in the tropics and under the ice, in the deep-oceans and the shallow littoral. They may also be required to conduct operations within internal waterways. These tasks may be delivered by multi-purpose or specialist underwater systems, or by a combination of both, although in most cases they will operate as a team of systems, providing a network capability across the operating environments. The inherently covert nature of underwater operations mean that they will be primarily employed up threat conducting sea denial operations (anti air, surface and subsurface warfare) and covertly conducting intelligence, surveillance and reconnaissance missions. When combined with land attack weapons, unmanned underwater systems will have a power projection capability of considerable range and penetration. They will also play a key role in mine countermeasures and mine/sensor-laying, and in hydrographic and oceanographic data gathering.

	2009 *Evolutionary Adaptation*	2015 *Revolutionary Adaptation*	2034
Obstacle Avoidance	Fixed Obstacle Avoidance	Dynamic Obstacle/Treat Avoidance	TMA Adaptive Re-Planning
Recognition	Object Recognition	Target Classification	Intelligent Identification
OPSEC	Minimize Detectability (Acoustic/ Electromagnetic/ Radar/IR)		Stealth Technology
Navigation	GPS/Inertial Navigation		Independent Navigation

Figure 3.3 – Maritime Performance Envelope[13]

[12] Technologies such as carbon nanotube networks may provide an attractive alternative for unmanned underwater systems.
[13] *FY2009–2034 Unmanned Systems Integrated Roadmap*, USA DoD, dated 6 April 2009, page 33.

THE SLOOP-OF-WAR

Hull Configuration

309. Recent work in the UK on future warship design concluded that a conventional monohull configuration was the most cost effective solution, especially (like the sloop-of-war) if high speed was not a requirement. Additionally, as the ship is a more akin to a lean-manned mother ship, providing mission planning and garage services for a range of unmanned and manned systems, it is well suited to this type of construct. Recently, the same conclusion was reached for a number of coastguard vessels whose monohull design is characterised by a short, high forecastle and forward superstructure, with a long, low cargo/working deck aft. The Norwegian Coastguard Vessel at Figure 3.4 is a good example.

Figure 3.4 – KV Barentshav Coastguard Vessel

310. The adaptation of this configuration for the sloop-of-war is illustrated at Figure 3.5. Most of the cargo deck has been plated in to provide a covered environment for the mission bay/workshops, with a hangar on top. The hull form has been derived from a commercial hull that provides the required volume, buoyancy and resistance properties at both the top and endurance speeds. Double curvature of the hull surface is minimised and parallel body maximised to reduce hull build and internal outfit costs. Maximum beam is taken aft to provide greatest transom width in order to allow operation of a stern ramp, stern mission module positions port and starboard and space for handling mooring lines.

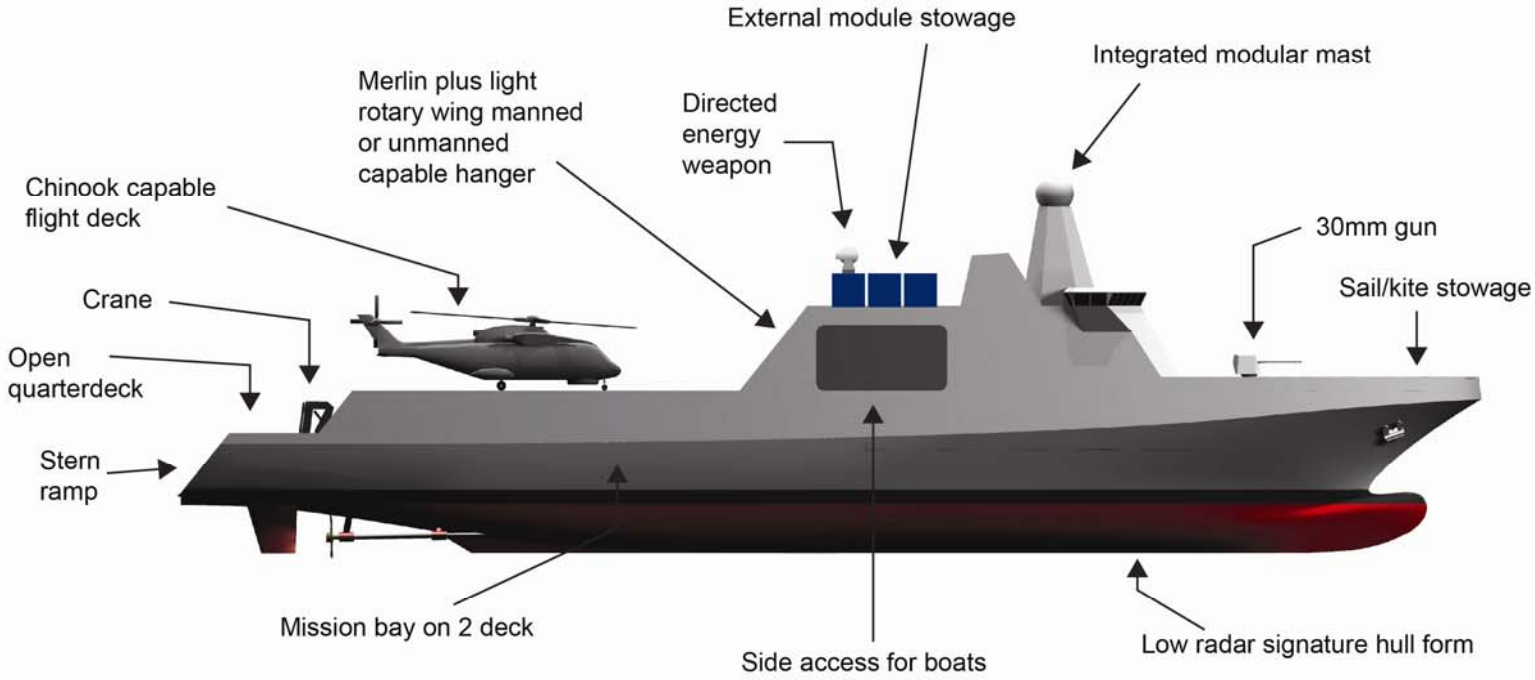

Figure 3.5 – Future 'Black Swan' Class Sloop-of-War Profile

311. The ship design has been created using a ship sizing tool that enables a balanced design to be rapidly derived and linked to a cost model. Once the model has been set up, cost capability trades can be readily accomplished to assess the implications of design changes.

Main Dimensions		**Tank capacities**	
Length overall	95.00m	Fuel oil	390 tonnes
Length (WL)	90m	Fresh water	24 tonnes
Breadth (WL)	15.50m	Additional fuel for Unmanned Systems	94 tonnes
Depth moulded	11.60m		
Draft	4m	**Main Machinery**	
Speed and Range		Generators	2 x Wartsila 8L201 1 x Wartsila 12V26
Top speed	18 knots	Propulsion motors	2 x 2MW electric motors
Range	10,000nm at 12 knots		
Deadweight and Draught		**Weapons (Fixed)**	
Deep Displacement	3150 tonnes	1 x 30mm gun	
Total mission payload	400 tonnes	2 x GPMG2 x miniguns	
Helicopter		**Accommodation**	
Flight deck	Chinook ramp down	Basic complement of 8 plus 32 mission planners	40 (HMS ASTUTE standard) inside the CBRN citadel
Hangar	Merlin + 1 rotary wing UAV	ISO container accommodation for at least 20[14]	In mission bay

Table 3.1 – The Future Sloop-of-War Principal Particulars

[14] This accommodation could be used for a number of maritime security and international engagement tasks where greater numbers of crew are required, or to accommodate trainees during routine operations.

312. **Payload Capacity and Adaptability**. The large hangar and mission bay provides a total of 970m^2 of deck area and 400 tonnes payload. This is similar to that achieved in the US Navy Littoral Combat Ship.[15]

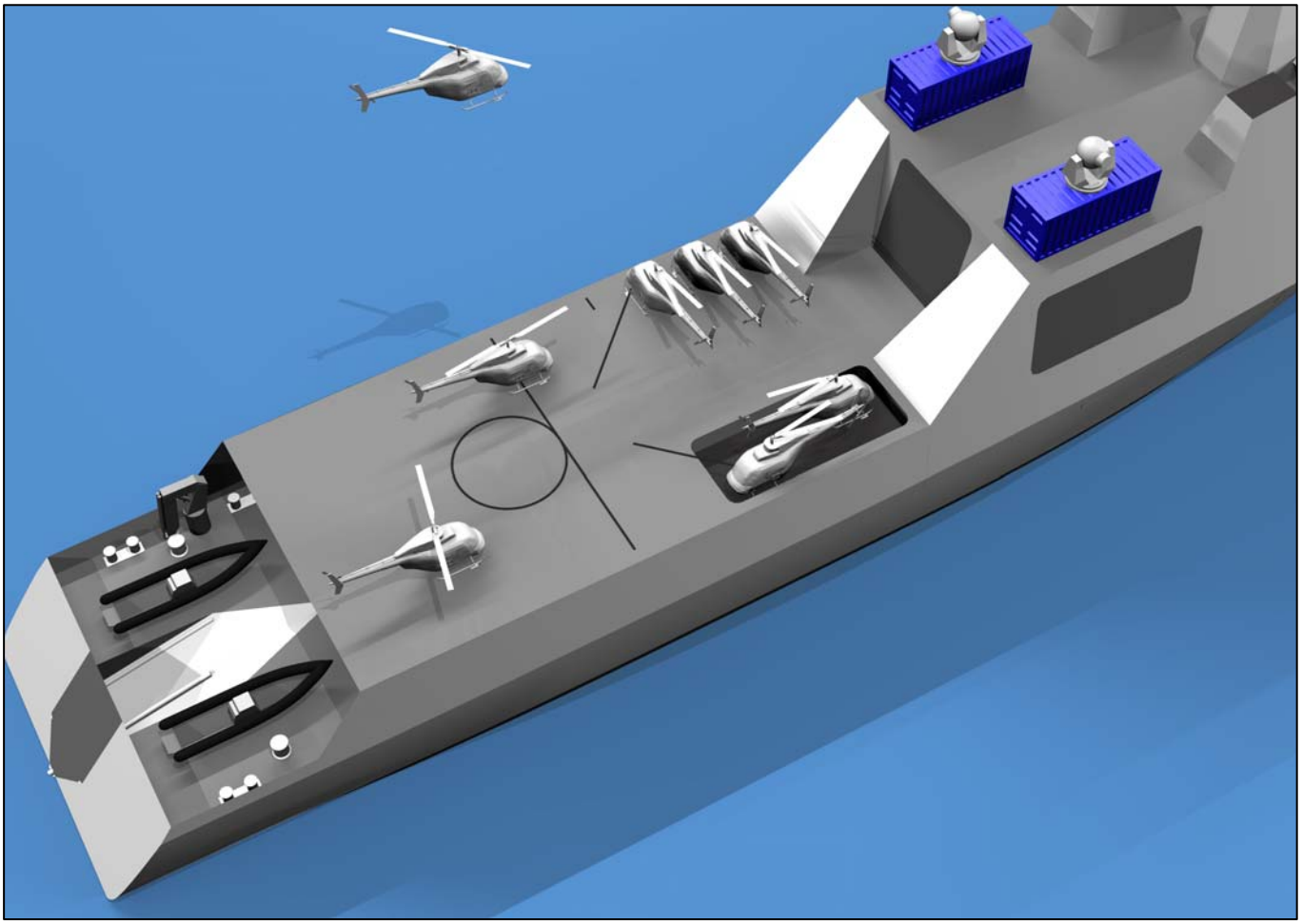

Figure 3.6 – Hangar/Flight Deck Arrangement

314. **Mission Bay**. The 600m^2 mission bay is included on 2-deck aft and is designed to accommodate the standard 20-foot ISO container.[16] The deck in the mission bay will be fitted with standard container twist-lock fixing points, which will require all embarked equipment to be secured in this manner. A suitable container handling system will be required in the mission bay (rails/ overhead gantry etc), with ships services such as power, compressed air, hydraulics and air conditioning supplied to each Twenty Foot Equivalent Unit (TEU) position, thus ensuring maximum flexibility. While the nature and size

[15] '*The Littoral Combat Ship is a fast, agile, focused-mission platform designed for operation in near-shore environments yet capable of open-ocean operation. It is designed to defeat asymmetric "anti-access" threats such as mines, quiet diesel submarines and fast surface craft*'. http://www.navy.mil/navydata/fact_display.asp?cid=4200&tid=1650&ct=4

[16] A 20 foot ISO container equals one Twenty Foot Equivalent Unit (TEU).

of the payload will depend upon the ships role, it is only by enforcing a recognised standard that the ship will be flexible enough to keep up with rapidly changing technologies. An open working deck area has been provided at the aft end of the mission bay, with the addition of a 25-tonne crane to enable modules to be loaded, and unloaded, without shore assistance. Two TEU locations are provided at the transom for systems that require direct access over the stern, such as towed array modules, or unmanned surface, or sub-surface deployment systems. A universal stern ramp is fitted on the centreline, capable of recovering manned and unmanned surface and sub-surface platforms with the minimum manning requirement. In addition, the ramp will also enable rapid refuelling, a feature that is also planned for the US Navy Littoral Combat Ship.

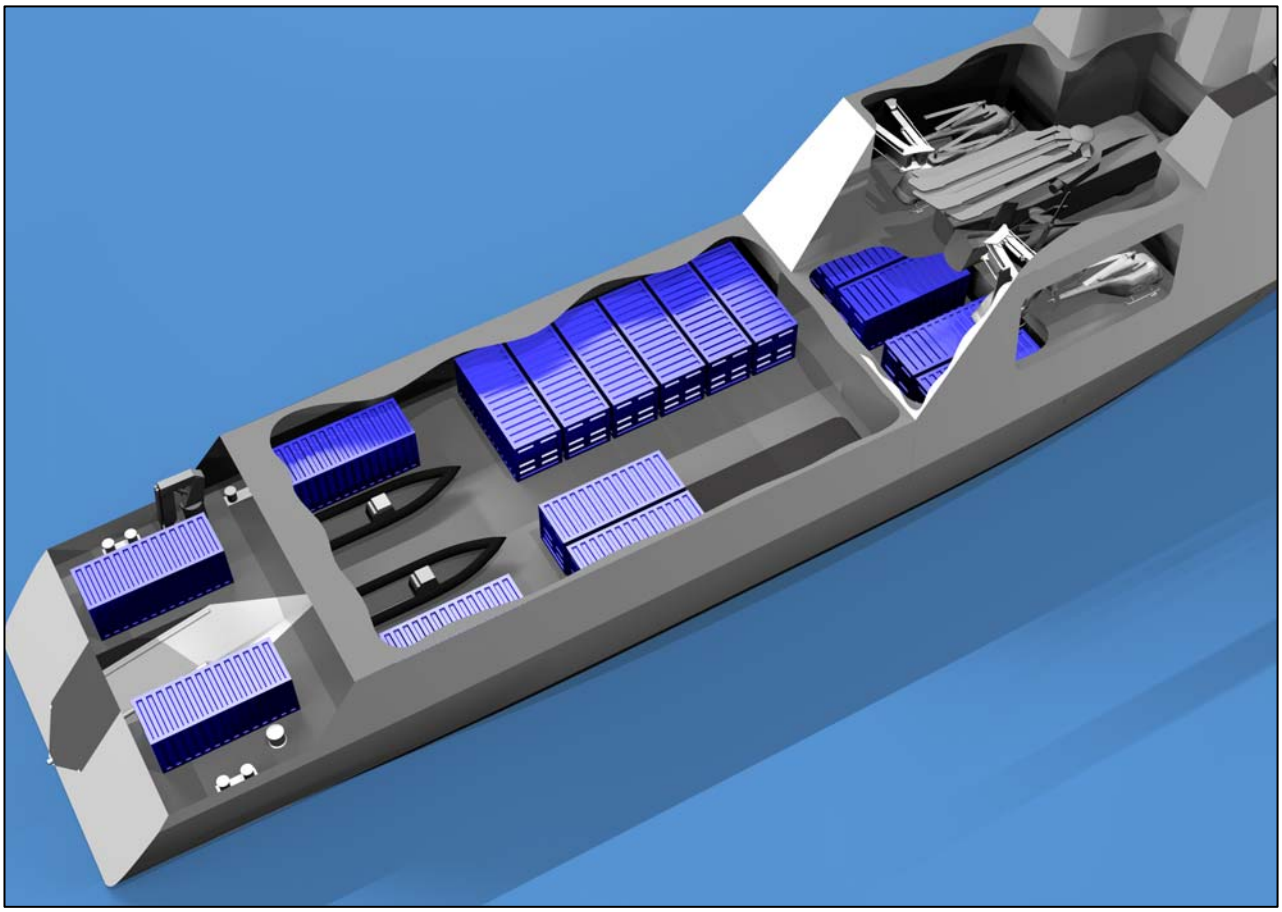

Figure 3.7 – A Possible Mission Bay Arrangement

315. **Speed and Range**. Since the sloop relies on the speed of its off-board systems rather than its own, the top speed for the ship has been significantly reduced resulting in large cost savings, both at build and in through-life costs. For this illustrative design, the top speed has been limited

to 18 knots to align with the transit speed of a maritime task force. This equates to an installed propulsion power requirement of 4 mega watts, as compared with a requirement for around 20 mega watts for 25 knots.[17] The operating profile is anticipated to include transit to the theatre of operations, generally at the most economical speed of 12 knots, before conducting low speed/loitering operations in the theatre of operation. This operating profile, biased towards low speed operation, will significantly reduce annual fuel burn by the ship. Further work, taking into account likely consumption by off-board assets in a number of scenarios, would be required to quantify the overall savings achievable through this concept of operation.

316. **Fuel**. The main fuel tanks have been sized to give 10,000 nm range at 12 knots. An additional 94 tonnes of fuel has been allocated for off-board systems (although fuel requirements will depend upon the sloops mission). It is hoped that by the time this ship enters service, a common fuel policy will have been adopted thereby, allowing greater flexibility between the ship's range and that of its off-board systems.

317. **Propulsion Machinery**. A low voltage electric propulsion arrangement has been selected in order to enable efficient operation at low speeds as well as to minimise overall installed power by allowing propulsion power to be traded for weapons systems demand. The cost of fossil fuels is forecast to increase significantly over the next few decades. A number of alternative energy sources are being considered for shipping. At this point the most promising involves directly harnessing the power of wind-utilising sails or kites. Recent trials on commercial ships have shown that significant fuel savings are achievable in this way. Other energy harvesting technologies, such as photovoltaic paint and collapsible wind turbines, although likely to be less effective overall, should also be considered.

318. **Accommodation**. Accommodation standards on Royal Navy vessels reached a peak in the Type 45 Destroyer. The resulting increase in volume demand on the ship can become a significant driver in both its size and cost. This has been recognised. Future programmes are looking at reducing accommodation standards. For this ship, the crew accommodation standard has been based upon HMS Astute, which results in the commanding officer

[17] The vessel size would need to increase by around 500 tonnes to accommodate the machinery required to achieve the higher speed, increasing cost by around £15M.

having his cabin reduced from the 41m^2 on a Type 23 Frigate, to a 5m^2 cabin and ratings in 3-tier bunk spaces. The same philosophy has been applied to all the accommodation spaces.

319. **Combat System**. With the need to keep costs down while maximising flexibility, the ship has been fitted with a minimal common core combat system. This includes a local area network, reconfigurable computer workstations and open architecture software, similar to that adopted in the Littoral Combat Ship and the Danish StanFlex system.[18] For the ships safety, a medium range 3D radar has been fitted. The rest of the baseline sensor fit has been minimised with a view to customised upgrades for the required role being delivered though modular fits, or distributed sensors on unmanned systems. The sloops will require information systems to allow them to integrate into a UK or coalition task force.

320. **Fixed Weapon Systems**. These are confined to the minimum required for self-defence and offer a limited anti-surface and anti-air capability. Additional weapon systems could be carried in the mission bay, hangar or upper deck module positions. The ship will be able to re-role independently using a logistic supply system involving ISO-containerised mission modules and onboard cranage.

321. **Survivability**. With resilience stemming from numbers, and the intent to keep the host platform outside the tactical weapon envelope of potential adversaries, cost has been reduced through adopting commercial standards where possible. If the risk to the platform from enemy action is low, then adopting commercial International Maritime Organisation conventions on subdivision and damage stability is a feasible option. '*For a combatant, adopting The International Convention for the Safety of Life at Sea*[19] *to define the safety limit would not be appropriate, unless the military value of the asset is equitable with the value and availability of a merchant ship*'.[20] This fits well with a philosophy of survivability through platform numbers. The

[18] Astle J, Galoria M and Rabbets T, *Combat System Modularisation*, QinetiQ/KI/C&IS/CR050318/1.0

[19] The International Convention for the Safety of Life at Sea (SOLAS), in its successive forms, is generally regarded as the most important of all international treaties concerning the safety of merchant ships. The first version was adopted in 1914, in response to the Titanic disaster, the second in 1929, the third in 1948, and the fourth in 1960. The 1974 version includes the tacit acceptance procedure – which provides that an amendment shall enter into force on a specified date unless, before that date, objections to the amendment are received from an agreed number of Parties. As a result, the 1974 Convention has been updated and amended on numerous occasions. The Convention in force today is sometimes referred to as SOLAS, 1974, as amended.

[20] Marshall S, *Tolerable Safety of Damaged Naval Vessels*, RINA Conference Proceedings, *The Damaged Ship* 2011.

adoption of this reduced standard permits a one-compartment damage standard, with a reduction of watertight bulkheads from around 8 to 4. This generates a significant cost saving, both in terms of hull structure and system complexity. It also reduces the amount of armour required. With the crew concentrated in the superstructure and hull under the bridge, this area can be economically armoured against small arms fire. The only other allowance for armour in the design is for protection to magazines. The relaxation of shock and other military standard requirements for machinery and other equipment will also have a significant effect on the cost of the platform. This philosophy sees a shift in emphasis from ship, to crew survivability.

322. **Cost**. A preliminary estimate[21] for the unit production cost of the sloop-of-war, built in a UK shipyard, using commercial norms, is **£65M** at 2010 financial conditions. Further work would be required to calculate these savings and the through-life costs of the platform. However, with a small core crew, reduced fuel burn, easy access to fewer onboard sensors and a markedly reduced maintenance burden, not only will the ship's availability increase but its overall cost will be far less than current warships. This figure does not take into account the cost of capability packages.

Capability Packages

323. The key to the cost effectiveness of this platform is the manner in which it can be reconfigured to suit a number of roles, hence ensuring that costly capability is only deployed when required. As highlighted earlier in this Chapter, unmanned systems will have a major impact on future maritime operations. However, predicting what the future capability packages will look like is extremely difficult. The following examples of possible configurations are, therefore, based on already mature capabilities. The future may be very different.

[21] This is a concept-level costing based on 40 hulls.

Possible Configurations in the Future	
Counter-piracy or counter-drugs	Crew: core crew (commanding officer OF4)[22] plus: aircrew, system handlers and boats/boarding team; total approx 40. Wildcat helicopter. 2 x rotary-wing unmanned air systems providing continuous coverage, with a third as a spare in the mission bay. 2 x rigid inflatable boats for boarding parties. Potential use of armed unmanned surface systems for force and asset protection.[23] Extra accommodation for trainees, or enforcement officers, could be provided in containerised accommodation modules in the mission bay.
Mine Hunting	Crew: core crew (commanding officer OF3 or OF2) plus: system handlers and mission planners; total approx 16. 3 x 11m unmanned surface systems to act as taxis for deploying mine-hunting unmanned underwater systems. A number of mission modules for transportation by the unmanned surface systems into the minefield. These would include towed sweep modules and underwater launch and recovery modules. 2 x rotary-wing unmanned air systems providing continuous coverage, with a third as a spare in the mission bay.

[22] Officer ranks are: OF2 Lieutenant, OF3 Lieutenant Commander, OF4 Commander and OF5 Captain.
[23] The Royal Singapore Navy successfully deployed Protector, a unmanned surface vessel, fitted with a camera, loudhailer and mini Typhoon weapon in a force protection role in the Gulf in 2005 http://www.mindef.gov.sg/imindef/publications/cyberpioneer/3g_saf/2005/features/may05_cs.html

Possible Configurations in the Future (Continued)	
Sea Control	A squadron of ships sharing the war-fighting capability packages of air, surface and sub-surface amongst themselves to maximise operational capability. This would take into account such factors as crew experience and the number required to operate each package. This could include a combination of Merlin and Wildcat manned helicopters alongside at least 8 rotary wing unmanned air systems. The total number of unmanned systems could be well over 50, especially if they include nano-sized systems. Crew: the force could be commanded at OF4 or OF5, with commanding officers at OF4 or OF3 rank. The crew complement in each ship would be 40, with a squadron of 4 ships requiring 160 personnel. ISO containerised missile modules could be fitted on the upper deck with long-range land, air and surface capability. ISO containerised sensors such as towed array[24] could also be included.

[24] Atlas engineering already offers a containerised system for streaming towed array sonar over the transom.

Figure 3.8 – A ‘Black Swan’ Squadron?