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With budget cuts looming for the United States military it is time to rethink what military requirements the United States requires. One of the most expensive systems within the United States military is the aircraft carrier and its associated air wing. As an expensive weapon system it is an easy target for cost reduction. The questions that must be answered in cutting a program like the aircraft carrier are: what roles does it fill, what capabilities does it possess, what capabilities are required, and what can fulfill the capabilities required if the program is eliminated. In addition to the capabilities resident in an aircraft carrier it is also important to look at the threats present to the aircraft carrier. As a symbol of United States power and a highly expensive weapons system, the aircraft carrier and its air wing are prime targets, both in military and political terms. In looking towards the future the strategic goals of the United States and the capabilities that threaten United States power, the age of the aircraft carrier should be brought to a close.

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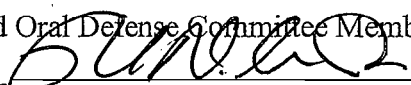
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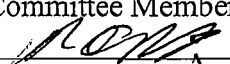
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Executive Summary

Title: Aircraft Carriers: More Cost Than Capability

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Thesis: The combined increases in the proliferation of anti-access/area denial increasing anti-access / area denial environment and cost of the aircraft carrier and its associated air wing require a new approach to the strategic, operational and tactical use of the aircraft carrier.

Discussion: With budget cuts looming for the United States military it is time to rethink what military requirements the United States requires. One of the most expensive systems within the United States military is the aircraft carrier and its associated air wing. As an expensive weapon system it is an easy target for cost reduction. The questions that must be answered in cutting a program like the aircraft carrier are: what roles does it fill, what capabilities does it possess, what capabilities are required, and what can fulfill the capabilities required if the program is eliminated. In addition to the capabilities resident in an aircraft carrier it is also important to look at the threats present to the aircraft carrier. As a symbol of United States power and a highly expensive weapons system, the aircraft carrier and its air wing are prime targets, both in military and political terms. In looking towards the future the strategic goals of the United States and the capabilities that threaten United States power, the age of the aircraft carrier should be brought to a close.

Conclusion: Technology exists and is in development that will make the aircraft carrier obsolete. While immediate disposal of aircraft carriers is not warranted, the United States should explore alternative technologies to fulfill the missions and roles of the aircraft carrier.

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Preface

I wrote this paper to extend the thoughts and debate regarding how the United States uses its most expensive and arguably most capable asset, the aircraft carrier. The intention is to consider what possibilities exist to fill a capability held almost exclusively by the United States, and certainly not held to the same degree by any other nation. With an increasing threat and decreasing budget it is easy to attack a costly system. It is difficult to fully define both the spectrum of capabilities an aircraft carrier possesses as well as the spectrum of capabilities required to be replaced. The possibilities often interfere with the current requirements and become a we have X, and we need it for A, B, and C but we can also use it to do D, E, and F, without determining if D, E, and F need to be filled by that capability or if something else can also fill that gap. Mission creep takes hold and the D, E, and F become something to latch onto as A, B, and C diminish, rather than letting the requirement retire. This may be the current fate of the aircraft carrier. That is what I desired to explore in researching and writing this paper.

I would like to thank Dr. Paul Gelpi my MMS advisor for helping to clarify and collate my thoughts. I would also like to thank Lieutenant General Paul K. VanRiper introducing me to the thought processes behind defining a military concept and how to apply those in making an argument for change.

In times of budgetary debates the question of the necessity of aircraft carriers is inevitably arises. The enormous costs to build, man and operate aircraft carriers make them an easy target for the cost conscious person. Proponents for aircraft carriers will point to aircraft carriers combat history, fighting capacity, cost benefit analyses that demonstrates that a bigger aircraft carrier is more capable than multiple aircraft carriers with the same number of aircraft and as reasons the aircraft carrier is still a vital instrument of the United States military. The aircraft carrier has played an important role in United States strategy during the past 70 years. Its role has been operational as well as symbolic; a demonstrated might and show of force. This importance has carried with it a large associated cost, in terms of both the aircraft carrier itself and its associated air wing. What is not clear is the future of the aircraft carrier, and the importance it will play in the future of the United States military and political realm. In looking at the history of the aircraft carrier, the strategic goals of the United States, the threats posed to U.S. naval assets and the technological advances anticipated in the next few decades, the aim of this paper is to demonstrate that the role of the super carrier has become, as some critics argued, superfluous.¹

A variety of ships exist which can carry aircraft, so what constitutes an aircraft carrier for this discussion? To simplify the dialogue, we will define an aircraft carrier as a ship whose primary role is to employ fixed wing aircraft, and recover those aircraft via an arresting gear recovery system.² Ships designed for amphibious assault, or anti-submarine operations, are not part of this discussion, even if they have the capability to launch Short Take-off, Vertical Landing (STOVL) fixed wing aircraft. Analysis of the past, current and future roles aircraft carriers play in the United States military requires this distinction, as does the possible and available alternatives. To place a displacement limit on the definition of an aircraft carrier,

denies a proper examination of the issue, as aircraft carriers have tended to increase in size since their inception. Size limits also affect discussions of relative strength of a force, as the size of aircraft carriers around the world varies greatly by country. For the United States it can become a matter of size as the current and future carrier force composition is *Nimitz* and *Gerald Ford* class carriers with displacements in excess of 90,000 tons.³

Historically a link exists in the minds of many people that an argument against an aircraft carrier is an argument against the need for naval aviation. This need not be true. The need for naval aviation is without question. The fact that water covers 70% of the globe and that 70-80% of the world's population lives within 200 nm of the coast speaks to the need for naval forces. The range limitations of surfaced based sensor technology, time latency and coverage limits of satellite sensors and increasing range of enemy weapons systems necessitate naval aviation to provide sensors at a range that places the chance for threat detection at a distance that allows timely response. What is questionable is whether or not this capability needs to reside in a system like the modern super carrier or if there are other assets capable of filling the roles and missions currently filled by the modern super carrier. The arguments for super carriers involve their persistence, versatility and sortie rate. The most used argument against super carriers is cost. As the anti-access and area denial (A2AD) threats increase concentration of cost and firepower in one platform becomes a greater vulnerability. Add to this the symbolism behind the aircraft carrier, a sign of American strength and military might, and it provides a target with significant military and propaganda value to a potential adversary.

Defining Roles

Shaping the requirements for aircraft carriers are the history of the aircraft carrier and the strategic documents that underpin the security of the United States. The history of the aircraft

carrier defines the doctrine and missions the U.S. has used to operate aircraft carriers in the past. The national strategic documents define the requirements for future military operations. These two views define what capabilities any platform, or group of platforms, require to replace the aircraft carrier.

Aircraft Carrier's Doctrinal Roles

Defining the “doctrinal” roles of an aircraft carrier takes a careful study of their history, as no official doctrine exists for the use of aircraft carriers in the United States.⁴ The word “doctrinal” is in quotations because there is no official doctrine on aircraft carrier use. Robert Rubel, the Dean of Naval Warfare Studies at the Naval War College in Newport, RI and retired U.S. Navy aviator captain proffers six “doctrinal” roles that aircraft carriers have filled in their close to century worth of existence. The roles he puts forward are eyes of the fleet, cavalry, capital ship, nuclear strike platform, airfield at sea and geopolitical chess piece.⁵ These roles stem more from the capabilities of the air wings embarked on an aircraft carrier, than the capabilities of the ship itself. A 2006 RAND Corporation study examined the combat and noncombat roles of the aircraft carrier. Their study looked at the capabilities of the ship in addition to the air wing revealing roles for the aircraft carrier including command and control, intelligence gathering, power generation and humanitarian assistance/disaster relief (HADR.) A closer examination of both of these studies provides a well defined look at both broad and specific capabilities and uses of aircraft carriers.

Early in the history of the aircraft carrier the intended use was as the eyes of the fleet. The light weight and lift capabilities of the aircraft initially regulated them to scouting ahead of the main battle fleet in order to provide the fleet increased time to maneuver into a battle formation before engaging an enemy. Evolutions in aircraft technology and the realization that

enemies would likely begin to use fighters to engage scouting planes began the move to use the aircraft on carriers to attack in addition to the scouting function. This led to changes in the composition of the air wing embarked on carriers, from scout plane centric to a mix of scout aircraft, fighters and eventually bombers and torpedo planes. Thus the role of the aircraft carrier expanded from eyes of the fleet to cavalry.

The cavalry role of the aircraft carrier involves it being a hit-and-run weapon.⁶ As a hit-and-run weapon the aircraft carrier is used in a way that does not put it at risk of direct engagement, placing it on the outskirts of the fight. Rubel argues the United States has not used an aircraft carrier in this role since 1986.⁷ Cruise missiles have supplanted carrier based aircraft in this role as they do not expose the aircraft carrier to the risks associated with steaming into an area to conduct a launch in addition to the risk to aircraft. The 2011 no-fly zone enforcement on Libya is a prime example. The United States launched in excess of 100 tomahawk cruise missiles to neutralize the Libyan air defenses and command and control prior to flying manned aircraft into the space.

Nuclear strike was a midterm doctrinal use of the aircraft carriers. As discussed before, this role was at the heart of the debate on the continued validity of the aircraft carrier at the dawn of the nuclear age. This role for the aircraft carrier has fallen into disuse, with numerous other assets being better equipped for this mission, including long range bombers, land based inter-continental ballistic missiles and submarine launched ballistic missiles. Aircraft carriers are still capable of deploying nuclear weapons, but it is not a current use of aircraft carriers.

Capital ships have been the center pieces of navies for years. They serve as a way to judge the relative strength of fleets. The image of a capital ship often brings to mind aircraft carriers or battle ships. Alternately, they can be considered the largest most heavily armed ships

in a fleet, the ship around which a fleet centers its formations and doctrine, or ships capable of defeating any other ship on the sea.⁸ Aircraft carriers still form the center piece of United States Navy formations, but in terms of armament and the capability to defeat other ships on the sea; this role has taken a downturn with the advent of the missile age. The capabilities of anti-ship and anti-air missiles are such that they negate the firepower capable from the aircraft on the aircraft carrier. Additionally the increased capability of submarines to launch both torpedoes and missiles makes them a significant threat to the aircraft carrier. While it is true that the fleet usually centers its disposition on the aircraft carrier, this is precisely because of its vulnerabilities, especially if the aircraft flying from it are operating against land based targets and not directed against an enemy fleet. The need for a capital ship comes into question in the current military environment.

Geopolitical chess piece is a role to form a catch-all for missions and capabilities not already discussed. It is here that the United States can move an aircraft around the world as a show of force, as a visible deterrent, or as a show of good will and an instrument of HADR. The capabilities of the aircraft carrier as a geopolitical chess piece come from the capabilities of the aircraft carrier itself, and often, more importantly, the capabilities of the aircraft embarked on it. This can have a big impact on the ability of the aircraft carrier to properly respond in an HADR role, as attack aircraft that normally compose the majority of the air wing are not useful in HADR. They are the combat power that adds a deterrent aspect to the aircraft carrier. Whether it is the strike capability of an embarked fighter-attack centered air wing or a vertical lift centered air wing for Humanitarian Assistance/ Disaster relief, the value of the aircraft carrier lies in the aircraft it embarks. It is important to note that the composition of an air wing is not easy to change. As discussed in the RAND study, to alter the mission from combat centric to noncombat

for an aircraft carrier involves changing out more than just the aircraft. In addition to the aircraft the maintenance support equipment differs as the air wing changes, making the shift between the two time consuming.

As the doctrinal roles above demonstrate, the crux of the aircraft carriers role is inherent in its name, to carry aircraft. With few exceptions, the aircraft embarked on an aircraft carrier either enhance or detract from its capabilities depending upon the requirement. That has been the historical look at carrier doctrine. To better determine what the future of the aircraft carrier will be it is necessary to look at the strategic documents that define the requirements for the United States military.

National Strategy

As the history of the aircraft carrier defines what the United States has used the aircraft carrier before, the national strategic documents define what capabilities the United States requires heading into the future. To begin to answer this question it is necessary to look at the National Security Strategy, and the defense and military strategies that flow from it.

Numerous strategic documents guide U.S. military planning. The highest level document is the *National Security Strategy* (NSS), followed by the *National Defense Strategy* (NDS)/*Quadrennial Defense Review Report* (QDR), and the *National Military Strategy of the United States of America*. In addition domain specific strategies exist, such as *Cooperative Strategy for 21st Century Seapower* (CS21CS) coauthored by the U.S. Navy (USN), U.S. Marine Corps (USMC), and U.S. Coast Guard (USCG). Occasionally leadership publishes interim guidance between periodic revisions through separate documents. Most recently in January 2012, the President and Secretary of Defense released *Sustaining U.S. Leadership: Priorities for 21st Century Defense* referred to as the Defense Strategic Guidance (DSG). These documents lay

down the strategic and operational environments that bear on the future utility of an aircraft carrier.

The President released the most recent version of the NSS in May 2010. It takes a whole of government approach⁹ stating that “To succeed we must balance and integrate all elements of American power”.¹⁰ In this light it looks beyond the capabilities inherent to the Department of Defense, and looks broadly at defense, diplomacy, economics, development, homeland security, intelligence, strategic communications and the American people and private sector.¹¹ Common themes of working with partners and allies and mitigating the risk of weapons of mass destruction (WMD) abound throughout the NSS. Specific to defense the NSS discusses: prevailing in today’s wars, preventing and deterring threats to the United States and its interests, allies and partners, defending the U.S. from state and non-state actors, rebalancing the military for counter terrorism, counterinsurgency, stability operations and increased security threats in an anti-access environment across the range of military operations including civil support, and preserving the all volunteer force.¹² These themes cross into the subordinate strategic documents.

In 2008 the Secretary of Defense released the latest version of the *National Defense Strategy*. No legislative requirement exists for this document. The legislative requirement that fulfills this policy guidance is the QDR.

The most comprehensive strategic defense document is the *Quadrennial Defense Review*. This legislative requirement defines the roles, missions and requirements for the U.S. military. It delineates requirements for force structure, both in specific numbers by service, and capabilities by domain. The QDR provides an analysis of how the U.S. military is postured to defend the nation’s security and what it may need to better achieve its security. Defined within the QDR are

six key mission areas: Defend the United States and support civil authorities at home, succeed in counterinsurgency, stability and counterterrorism operations, build the security capacity of partner states, deter and defeat aggression in anti-access environments, prevent proliferation and counter weapons of mass destruction, and operate effectively in cyberspace. These key mission areas cross through all the defense themes in the NSS. To provide further clarity for mission and force requirements the QDR breaks each of these key missions into key initiatives. In total there are 32 initiatives under the six key mission areas, of which the carrier and its air wing have a possible role in no more than 14.

In addition to the six key mission areas and their sub-initiatives, the QDR focuses discussion on four defense objectives related to sizing and shaping the force. These four objectives are: prevail in today's wars, prevent and deter conflict, prepare to defeat adversaries, and succeed in a wide range of contingencies and preserve and enhance the force. To further aid in defining force structure it The QDR takes the key missions and links them to the four objectives. As stated, the missions and objectives are also broken down by domain. The naval and air forces' requirements discussed bear on the utility of the aircraft carrier. The naval force requirements are: forward presence, power projection, work with a wide range of partner navies, and sea and land based ballistic missile defense capabilities. Air forces' requirements are: deter and defeat adversaries fielding more potent anti-access capabilities and training and advising partner air forces. Together the missions, initiatives, objectives and force capabilities defined within the QDR provide a framework for U.S. military strategy and force structure.

The 2011 *National Military Strategy* laid out four overarching strategic imperatives for the United States military, counter violent extremism, deter and defeat aggression, strengthen

international and regional security and shape the future force. The common themes from the NSS and QDR follow through this strategy, with direct references to both documents.

In January 2012 an updated defense strategic guidance was release in the form of the *Sustaining U.S. Leadership: Priorities for 21st Century Defense*. The DSG specified 10 missions for the armed forces: counter-terrorism and irregular warfare, deter and defeat aggression, power projection despite A2AD challenges, counter weapons of mass destruction operate effectively in space and cyber space, maintain a safe, secure, and effective nuclear deterrent, defend the homeland and provide support to civil authorities, provide a stabilizing presence, conduct stability and counterinsurgency operations, and conduct humanitarian, disaster relief, and other operations. It draws these missions from the NSS, while shifting focus of attention from the current operations in Afghanistan to the Asia Pacific region.

The combined staffs of the USN, USMC, and USCG developed the most recent maritime strategy, *Cooperative Strategy for 21st Century Seapower* in 2007, prior to the most recent NSS. While not as current as the other national strategic documents the USN still derives its core capabilities from this document. These core capabilities are: forward presence, deterrence, sea control, power projection, maritime security, and HADR. Forward presence is placing maritime forces in areas away from the United States ready and capable of responding to threats. It involves forward deploying forces in locations around the world whether at forward bases or operating in international water. Deterrence goes hand-in-hand with forward presence. It is demonstrating the capabilities of the United States military and working with other nations to prevent and dissuade potential enemies from attacking the United States or its interests. Maintaining the ability to freely operate in the maritime domain is the purpose of Sea Control. This includes the ability to neutralize enemy forces and neutralize the effectiveness of enemy

anti-access/area denial capabilities. “Our ability to overcome challenges to access and to project and sustain power ashore is the basis of our combat credibility,” is the essence of Power Projection. In the same vein as deterrence, forward presence and sea control it is maintain forces forward deployed and able to overcome anti-access challenges. Maritime Security focuses on the non-military threat aspect of the maritime domain. This involves countering illicit activity that disrupts the freedom of navigation of merchant shipping and that represent trans-national threats. HADR is relies forward presence and capabilities of the U.S. Military forces and Coast Guard to respond to natural disasters and human suffering. It is the non-violent use of military power and resources to ease human suffering throughout the world. These capability requirements, while defined prior to the current national security documents, still hold true and cross reference through the current strategic documents.

The core missions the CS21CS discuss crosslink to the current NSS, DSG and supporting strategic documents. Deterrence is a theme common across the strategic documents. . Maritime Security and Sea Control discussed in the CS21CS fulfill capabilities in prevailing in today’s wars and defending against state-and non-state actors. CS21CS fills civil support and actions across the range of military operations discussed in the NSS through HADR, Maritime Security and Sea Control. The broad capabilities outlined within the NSS and subordinate documents, including the CS21CS complement one another, and allow the CS21CS to continue to guide the U.S. Navy even though it predates the current NSS and DSG.

Roles Fulfilled

Common themes across the strategic documents are presence, deterrence, defeating adversaries, partner nation support, and support to civil authorities/HADR. Defeating

adversaries includes counter terrorism/counterinsurgency, WMD, and future threats, among others. The aircraft carrier has capabilities in all these realms.

A deployed aircraft carrier is a forward presence for the U.S.A. and an element of power projection. The aircraft that fly from the aircraft carrier can further spread the presence of the United States, if only for a limited duration. With 70% of the Earth's surface covered in water and the ability of the aircraft carrier to travel on that water around the globe, it can provide worldwide presence.

As part of the military might of the United States and a symbol of power the aircraft carrier has some amount of deterrent effect. How much deterrence an aircraft carrier and its air wing have is something that cannot be measures. The symbolism of the aircraft carrier and the ability to project power provide it some level of deterrence.

When it comes to defeating adversaries aircraft carrier operations support this mission in many ways. Aircraft flying from aircraft carriers conducted operations in Libya, to support the NATO no-fly-zone. Carrier based aircraft conduct operations over Afghanistan, contributing to the winning of today's wars, including counter-terrorism and counterinsurgency operations. Aircraft launched from carriers can conduct strikes against known or suspected WMD production and launch sites, contributing to this mission. Special Forces can use aircraft carriers as staging areas to support irregular warfare capabilities. In a naval role, the fighter-attack aircraft and anti submarine helicopters that compose part of the air wing contribute to maritime security and sea control by attacking enemy submarines and surface ships. The attack aspect of the air wing has implications in defeating threats, on, over and under the ocean and on land.

Aircraft carriers support partner nations in numerous ways. Their ability to host civilian and military people and leadership from other countries can help build relationships with other

countries. Operating with other nations on the ocean or with other nation aircraft helps to build partner nation tactical and operational proficiency.

Multiple capabilities of aircraft carriers contribute to their ability to support civil authorities. Inherent to the aircraft carrier are its power generation capacity, its fresh water production capacity, its command and control systems and its hospital. Aircraft carriers have a 50 bed hospital facility and the capability of producing over 400000 gallons of fresh water a day, positive attributes for HADR missions.¹³ The large power generation capacity can also benefit civil authorities as CV-2 *USS Lexington* demonstrated in 1929 providing power to the city of Tacoma.¹⁴ Because of the staffs embarked on aircraft carriers, and the need to control aircraft and other ships they have significant communications and command and control systems, which allow them to be used as mobile command centers. These capabilities are inherent to the ship itself and not the embarked air wing.

Limitations

While highly capable aircraft carriers have numerous limitations. The various limitations include their capability to act as a deterrent, their cost, and their vulnerability in an A2AD environment. Even capabilities that appear to an advantage, such as nuclear power, the air wing composition and power projection have their limitations.

Deterrence

The capability of an aircraft carrier to act as a deterrent is debatable. One definition of deterrence is “persuading an opponent not to initiate a specific action because the perceived benefits do not justify the estimated costs and risks.”¹⁵ When it comes to military actions there are military as well as non-military factors that can play on the decisions.¹⁶ Part of the overall deterrence calculus is the military aspect and the ability to apply force. How much one platform

plays into this calculus is hard to determine. What potential enemies or deterees most likely have in their calculus is the amount of damage the deterrer is capable of levying on them, versus the desired end-state and ability to levy damage on the deterrer.¹⁷ In considering deterrence one must also keep in mind the possibility that deterrence will fail.¹⁸ If that is the case, advocates of placing an aircraft carrier or carrier strike group (CSG) in a potential hotspot as a deterrent must determine if it is worth the possible sacrifice. The same symbolism of strength that makes an aircraft carrier a deterrent can also make it a worthy target for an adversary who is determined to conduct an action, regardless of the desired outcome of a deterrer. The numbers of wars that have occurred demonstrate that “that the threat to use force, even what sometimes looked like superior force, has often failed to deter.”¹⁹ While the combat power of an aircraft carrier is significant, it is not always superior force, and it is more likely the mix of military and non-military capabilities and actions that play into the deterrent effect upon a given adversary, not a particular platform or capability. If the desired deterrence effect is a determination of intent, i.e. placing an aircraft carrier or CSG in a hotspot as a potential target with the capability to conduct retaliation or an ability to “hold ground” while awaiting reinforcements it can fall into a trap of its own making. If the enemy is determined to attack the U.S. an aircraft carrier is a wonderful target in terms of capability, money and symbolism. Less costly platforms are available to help determine intent, with striking capability should deterrence fail.

Nuclear Power

The aircraft carriers in the U.S. inventory are nuclear powered.²⁰ This gives them an advantage that they do not need to resupply propulsion fuel and is a key factor when talking about their endurance. This appears to be a great advantage to the aircraft carrier, it “can remain on station for months at a time”²¹. The first limitation comes from completing the sentence,

“replenishing ordnance, spare parts, food, consumables and aircraft fuel.”²² All ships in the U.S. Navy can remain on station for months at a time if they resupply their food, fuel, ammunition and consumables, so this is not an advantage for the aircraft carrier.

Nuclear power has the advantage that high speed operations do not significantly deplete it, allowing an aircraft carrier to transit at higher speeds than other vessels and still arrive without the necessity to take on fuel. However, aircraft carriers rarely, if ever operate alone. One or more ships escort an aircraft carrier ,even in peacetime deployments, to provide defense, acting as part of a group of ships known as Carrier Strike Group.²³ These escort ships not nuclear powered, as Navy analysis indicates that operating ships below 21,000 metric tons (which includes all DDGs, CGs, FFGs, and LCS) is more cost efficient when they are conventional powered as long as crude oil prices are less than \$210-\$670 a barrel.²⁴. This means that the escort ships are limited in endurance and dependent upon resupply of fuel to remain with the aircraft carrier during operations. The seeming advantage of nuclear power for endurance isn't as attractive if all the other requirements are brought to light.

Anti-Access/Area Denial (A2AD)

Aircraft carriers operate as part of a CSG for defense of the carrier. CSG operations become even more important in an A2AD threat environment; operating in the environment is part of the NSS and DSG. The A2AD threat comes in the form of mines, anti-ship cruise missiles (ASCM), anti-ship ballistic missiles and submarines. Aircraft carriers and their air wings have little inherent defense against any of these threats. An aircraft carrier has no submarine or torpedo detection capability; it gains this from the CSG and from anti-submarine (ASW) helicopters embarked as part of the air wing. DDGs, CGs and FFGs that deploy as part of the CSG all have inherent submarine and torpedo detection capabilities, as well as normally

operating with 2 ASW helicopters embarked.²⁵ No aircraft within the air wing or system onboard the carrier has a capability against ballistic missiles, once again relying on the CSG for this capability. Aircraft carriers have self-defense capabilities against ASCM, but only at a very close range. To engage the threat at distance another surface vessel such as a DDG or CG is required. While the A2AD threat exists for all U.S. forces, the cost involved in an aircraft carrier, and the need to place more ships into harm's way to defend it, exacerbates the risk involved.

Cost

In brief the aircraft carrier *can* fit into the conduct of the United States military strategy, and currently does, with the QDR calling for 10-11 aircraft carriers and 10 carrier air wings to complement them. The question is, is it really a *necessary* piece of fulfilling the military strategy of the United States? An aircraft carriers design life is approximately 50 years. This includes a midlife refueling of its nuclear reactor. GAO estimated the lifetime construction and operating cost of a *Nimitz* class aircraft carrier at 22 billion dollars in a 1997 study. That is 4.5 billion (average) for construction, 2.4 billion for midlife refueling, and an annual operating cost of 298 million dollars for the ship.²⁶ These costs do not include the procurement and operating cost of the air wing that provides the ship its combat power. The *Gerald Ford* class costs considerably more to build, 10.5-13.8 billion a copy.²⁷ In the current Navy 30 year shipbuilding plan the Navy projects building one *Ford* class every 5 years for the next 30 years. The average time to build an aircraft carrier is 3.5 years looking at the records for the *Nimitz* class aircraft carriers. Amortized out, that is 2-3 billion dollars a year the United States will spend, just to build aircraft carriers for the next 30 years.²⁸ Add on to this the cost of the air wing, the combat power behind the aircraft carrier. A average current air wing is composed of four fighter/attack

squadrons of 10-12 aircraft each, and electronic warfare squadron of 4 aircraft, an airborne command and control squadron of 4 aircraft, 2 carrier onboard delivery aircraft and a helicopter squadron of 6 aircraft. This comes in at a total cost of 2.33 billion dollars. As the F-35 replaces the F/A-18C/D and the EA-18G replaces the EA-6B this cost increases to 4.66 billion dollars. This is only the cost to purchase the aircraft and does not take into account the cost to operate the aircraft, including the training time and maintenance to maintain pilot proficiency. Take into account that the average design lifetime of an aircraft is approximately 6000 hours at a usage of 250 hours a year and an air wing requires replacement at twice the rate of the carrier it operates from.²⁹ Adding to that cost is the 20 percent additional aircraft required to maintain pilot proficiency. Then take into account that only approximately 10 percent of overall flight time AFTER training is combat time, the cost of maintaining a carrier and its air wing is significant.³⁰

Construction costs are easy to compare from ship type to ship type. It is hard to accurately determine the cost of a ship class until at least the first ship of that class has been constructed. The issues here lay in the unknowns of new technology integration costs. What is almost universally accepted is the final cost of at least the first ship of a class will be higher than the initial cost estimate of ship. This is part of the cost estimate disparity for the *Gerald Ford* class aircraft carriers.

Ship construction costs for the current and projected ships in the U.S. Navy vary by class. Navy projections of cost for the Littoral Combat Ship (LCS) are \$538 million per ship for procurement and 36.7 million per year over a 25 year life span.³¹ This equates to the ability to buy 19 LCS for the cost of one *Gerald Ford* class aircraft carrier (at the low estimate of \$10.4 billion) and operate 11 a year, on the same operating budget, so roughly 10 to one on ships buy and operate time. Current an *Arleigh Burke* class DDG costs the USN 2.3 billion dollars. This

translates to the capability for the USN to build 4.5 of these multi-mission ships for the cost of one *Gerald Ford* class.³² For the next generation DDG the *Zumwalt* class, there is a 2.8 to one build capability at a cost of 3.67 billion each.³³ The lifespan estimate of a DDG is 35-40 years, equating to three *Arleigh Burke* class and two *Zumwalt* class in service for every carrier in service. Take into account the cost of an air wing and the U.S. can build 1-2 more DDGs for the cost of the air wing. Manpower for these ships is considerably less than that of an aircraft carrier (276 for an *Arleigh Burke* class and 148 for *Zumwalt* class)³⁴ less than one ninth that of just an aircraft carrier alone. Aircraft carriers require an air wing to provide combat power. An air wing consists of five to ten times the number of personnel on a DDG,³⁵ and can cost as much as 2 DDGs. The U.S. Navy procures submarines for a cost of \$2.6 billion for the *Virginia* class SSN allowing 4 to be bought for the same price as an aircraft carrier.³⁶ They also save on manpower costs, with a crew of 132, less than one twentieth of an aircraft carrier's manpower, not including the air wing.³⁷ Over all procurement and operating costs of other ships is greatly less than that of the aircraft carrier and its air wing.

Air wing Composition

A standard air wing is comprised of aircraft that focus on strike and air defense. In the role of geopolitical chess piece the United States often calls upon aircraft carriers to conduct HADR. When this occurs the limitations of an air wing affect the ability of the aircraft carrier to act in this role. HADR missions often require a vertical lift capability greater than that available in a standard carrier air wing.³⁸ While the endurance of an aircraft carrier allows it some ability to rush to a staging area to change-out the air wing, this implies having those aircraft pre-positioned in areas to have easier access to them. The air wing change-out would also require time,

delaying the response time to a given disaster. An air wing sourced to conduct strike and attack missions, is therefore limited in its ability to conduct HADR.

Power Projection

Power Projection and the aircraft carrier are synonymous. One proponent of the aircraft carrier stated that “Heavy investment in submarines and ballistic missiles may be the best choices for a China interested in fighting and winning wars, but not for a China that wants to play a role in the most important political decisions made in international society.”³⁹ This is an interesting statement, with questionable relevance. Winning a war is a definitive statement of politics. As a member of the United Nations Security Council, China plays an important role in political decisions in international society. Of the five permanent members of the United Nations Security Council two do not have aircraft carriers as defined within the context of this paper the United Kingdom and China. The weight of their veto power in that international political body is not reduced by their lack of aircraft carriers.

In projecting power inland there is a limit to the unrefueled range of carrier based aircraft. With carrier based aircraft conducting operations in Afghanistan with a combat range of 900 nm, range appears to be of little concern.⁴⁰ However to accomplish missions at this range airborne refueling is required. Airborne refueling, often accomplished by Air Force refueling planes, can extend the range of carrier based aircraft. Air Force refueling planes require land based airfields for launch and recovery, negating the aircraft carrier advantage of not requiring host nation support. To exploit the aircraft carrier advantage of not requiring host nation support, carrier based aircraft can use organic tanking, where the aircraft carrier launches its own aircraft with extra fuel tanks instead of ordnance in order to refuel other aircraft. Organic tanking assets degrade the combat power of the aircraft carrier by absorbing flight hours for both the pilot and

aircraft that do not involve dropping ordnance. This means that to drop a given amount of ordnance requires more sorties while decreasing number of assets available to drop ordnance.

Proponents of the aircraft carrier tout the numbers of operations carrier based aircraft have conducted over Afghanistan (30 percent) as evidence of their continued importance.⁴¹ As a counterpoint, while 30 percent of the missions are flown by carrier based aircraft, B-1 bombers fly only 5 percent of the missions but are responsible for dropping over 40 percent of the ordnance.⁴² One of the limiting factors in the missions over Afghanistan is the endurance of the aircraft, which trade ordnance for fuel. Even with the ordnance for fuel trade the aircraft required multiple refueling to make the round trip operations over Afghanistan.

Alternatives

Due to the long design life of the aircraft carrier, if the United States stopped building aircraft carrier after completion of the *USS Gerald Ford* in 2015 they will still have an aircraft carrier in its inventory through 2065. What this infers is that the immediate demise of the aircraft carrier is not in order, and the United States can phase replacement capabilities into effect. The doctrinal roles of the carrier as well as the missions from strategy define the capability requirements of the aircraft carriers' replacement. The air wing provides much of the aircraft carriers capabilities. This requires any solutions to address these capabilities in addition to the capabilities inherent in the aircraft carrier.

Stepping through the doctrinal roles of the aircraft carrier begins with the initial role of the aircraft carrier as the eyes of the fleet. This role has taken on a diminished importance for the aircraft carrier. Currently P-3 aircraft, unmanned aerial vehicles (UAV), and helicopters conduct much of the surveillance mission for the USN. In the future, additional unmanned systems, including unmanned surface vehicles (USV) and unmanned undersea vehicles (UUV) will

provide additional capability for surveillance. These vehicles provide a capability to detect, observe and pass information back to ships and submarines, without putting a pilot into harm's way.

Cruise missiles have supplanted the cavalry role of the aircraft carrier and its air wing. With a combined total of over 100 ships and submarines capable of firing Tomahawk cruise missiles, a much greater capacity to hit land targets all over the world exists than with the 11 dropping to 10 aircraft carriers in the inventory. With ranges in excess of 700 nm⁴³ they have the ability to strike land target at a range aircraft can only attain with multiple refueling. For hit and run against targets at sea ships and submarines provide this capability via guns, anti-ship cruise missiles and torpedoes. The capabilities are on the increase, as longer range gun systems are poised to enter the fleet with the ability to hit surface, air and land targets.

The days of the aircraft carrier as a nuclear strike platform are long gone. Ballistic missiles fired from submarines and land stations have supplanted the aircraft carrier in this role. Additionally, long-range bomber aircraft have the capability to fulfill this role. The continued procurement of these systems will negate the need for aircraft carriers to fulfill the nuclear strike platform into the future.

The doctrinal roles of airfield-at-sea and geopolitical chess piece tie into the national strategic documentation roles of presence, deterrence, defeating adversaries, partner nation support and support to civil authorities/HADR. There are numerous capabilities the United States has and is developing that can replace the aircraft carrier in these roles

All USN ships from FFGs, DDGs and CGs to amphibious ships provide presence missions when they are operating around the world. With other ships costing significantly less than an aircraft carrier and its air wing, the United States could actually increase its presence by

purchasing more ships with the cost savings over an aircraft carrier and its air wing. In addition land based manned and unmanned aircraft provide presence over battlefields. The long range capability of today's intercontinental bombers allows them to project presence from the United States, without the requirement for host nation support. Unmanned aerial and surface vehicles can help provide presence into the future, extending the range of surface and air presence from their host ship. LHD and LHA ships ("big deck amphibs") maintain a power projection and force application capability through their small amount of strike combat power in addition to their vertical lift capabilities. With six STOVL fighter/attack aircraft and 4 attack helicopters as part of the air wing, a big deck amphib has a small ability to project combat power from the air.⁴⁴

Deterrence is a mission that no single ship or capability carries alone. The conglomerate of United States military capabilities, along with non-military government intervention act as a deterrent to enemies of the United States. The combined fire power of the ships, submarines, aircraft and land forces all play into an enemy's calculus prior to taking action. The proximity of a deterer's military power can also play into the deterrence calculus. In this manner increased presence operations can increase proximity and possibly increase the viability of a deterrence threat.

To defeat current and future adversaries many technologies combine to fill this role. The "cavalry" capabilities of anti-ship and land attack cruise missiles are part of the capability to defeat adversaries. Armed unmanned systems on, over and under the surface of the water provide additional capabilities against potential adversaries. In Libya U.S. ships and submarines launched in excess of 100 tomahawk cruise missiles to support the no-fly-zone. In the counter-terrorist/counter-insurgency fight in Afghanistan UAVs provide target identification and strike capabilities. The same UAVs, as well as USVs can help attack WMD locations, narcotics

smugglers and other navy ships, adding to the ability to defeat adversaries. Further capabilities to defeat adversaries at sea exist through submarines, capable of launching ASCM and torpedoes at surface ships. Air Force long range bombers can also provide the power projection and force application to defeat aggressors. Most of these capabilities currently exist. Those capabilities that do not currently exist, such as some of the unmanned systems, are in development and projected to be available well before the retirement of the *USS Gerald Ford* in 2065.⁴⁵

Amphibious ships, command ships and surface ships fill the mission of supporting partner nations. All these ships have the capability to host functions to build relationships with other countries according to their size. Smaller ships can integrate into the maneuvers and operations of other nation ships with added ease over the aircraft carrier, as the ships are closer in size and capability of the other nations' ships.

The United States uses amphibious ships in addition to aircraft carriers to conduct HADR/civil support missions. The increased vertical lift capability and 60 bed hospital facility of the big deck amphibs and their associated air wing make them excellent candidates for HADR missions.^{46 47} In addition to improved vertical lift capabilities amphibious ships provide a surface lift capability that is not possible from an aircraft carrier. Command and control capabilities for civil support are inherent in big deck amphibs just as they are inherent in the aircraft carrier. Big deck amphibs have the advantage over an aircraft carrier in an HADR in their air wing composition. With significantly more vertical lift capability on an LHA or LHD than on an aircraft carrier it does not required a change in air wing to help support HADR. Other amphibious ships can provide HADR capabilities through their surface lift capabilities as can hospital ships with their medical capabilities. The enhanced capability of amphibious ships and

hospital ships in conducting HADR/civil support makes them better candidates for these missions.

One aspect of the carrier remains to be explored, both in its defense and in pushing for its demise, and that is its symbolism. Symbolism is part of power projection and forward presence, the symbol of power inherent in the sheer size of an aircraft carrier. Dr. Robert Farley, and assistant professor at the Patterson School of Diplomacy and international commerce at the University of Kentucky stated that the question is not “do we need aircraft carriers, and if so which kind” rather, “what do our naval aviation choices indicate about the role we play in international society.”⁴⁸ This points to the unquantifiable aspects of the carrier as a symbol. In an increasing A2AD environment the question must be asked, “What happens when a symbol falls?” In the event of hostilities, what if the carrier is the first ship severely damaged or sunk? What if the “Pearl Harbor” of the future comes, bringing about the destruction of the United States carrier fleet, and the airpower that is inherent with it? The answer to this last question is that other capabilities exist to fill the roles aircraft carriers and their air wings provide. As Admiral (ret) Stansfield Turner points out, it is hard “for military organizations to abandon familiar weapon systems.”⁴⁹ So it is with the aircraft carrier. The symbolism of the aircraft carrier is familiar to the USN, having been the mainstay of the fleet since World War II.

Conclusion

With numerous capabilities in existence to fill the missions currently held by the aircraft carrier and its air wing at a fraction of the cost, the need for the aircraft carrier is waning. With procurements in process to guarantee an aircraft carrier in the U.S. inventory till 2065 it is time to examine the alternatives and restructure the USN away from the aircraft carrier. The

combination of symbolism, cost, numerous alternatives and an ever increasing A2AD threat lead to the eventual removal of the aircraft carrier from the United States inventory.

¹ Stansfield Turner. "Aircraft Carriers Are On Their Way Out" *Proceedings* 132.7 (July 2006) pg 16-18 <http://www.proquest.com/>

² Robert Rubel. "The Future of Aircraft Carriers" *Naval War College Review* 64 no.4 (Autumn 2011), 14

³ <http://www.navy.mil/navydata/fact.asp>

⁴ Rubel, 14

⁵ Rubel, 15-17

⁶ Rubel, 15

⁷ Rubel, 22

⁸ Rubel, 15

⁹ President of the United States. *National Security Strategy* May 2010. Washington: The White House, May 2010, 14

¹⁰ President of the United States. *National Security Strategy* May 2010. Washington: The White House, May 2010, 5

¹¹ President of the United States. *National Security Strategy* May 2010. Washington: The White House, May 2010, 14-15

¹² President of the United States. *National Security Strategy* May 2010. Washington: The White House, May 2010, 14

¹³ John Gordon and others. *Leveraging America's Aircraft Carrier Capabilities: Exploring New Combat and Noncombat Roles and Missions for the U.S. Carrier Fleet*. (RAND Corporation, 2006), 19

¹⁴ Gordon, 29

¹⁵ John J. Mearsheimer. *Conventional Deterrence*. (Ithica N.Y.: Cornell University Press, 1983), 14

¹⁶ Mearsheimer, 14

¹⁷ Bernard Brodie. *Strategy in the Missile Age*. Princeton, N.J.: (Princeton, N.J.: Princeton University Press, 1959; Princeton University Press, 1965), 276-278 Citations are to the 1965 edition.

¹⁸ Brodie, 296

¹⁹ Brodie, 272

²⁰ <http://www.navy.mil/navydata/fact.asp>

²¹ Naval Aviation Enterprise. *Naval Aviation Vision*. Arlington VA: Department of the Navy, January 2012. <http://www.cnaf.navy.mil/nae>, 17

²² Naval Aviation Enterprise. *Naval Aviation Vision*. Arlington VA: Department of the Navy, January 2012. <http://www.cnaf.navy.mil/nae>, 17

²³ <http://www.navy.mil/navydata/ships/carriers/powerhouse/cvbg.asp>

²⁴ Ronald O'Rourke. *Navy Nuclear Powered Surface Ships: Background, Issues and Options for Congress*. CRS Report for Congress RL33946. (Washington DC: Congressional Research Service, January 18, 2011), 9

²⁵ <http://www.navy.mil/navydata/fact.asp>

²⁶ General Accounting Office. *Navy Aircraft Carriers Cost Effectiveness of Conventionally and Nuclear-Powered Carriers*. (Washington, DC: General Accounting Office, August, 1998), 74

²⁷ Ronald O'Rourke. *Navy Ford (CVN-78) Class Aircraft Carrier Program: Background and Issues for Congress*. CRS Report for Congress RS20643. (Washington DC: Congressional Research Service, February 28, 2012), 7

²⁸ Ronald O'Rourke. *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*. CRS Report for Congress RL32665. (Washington DC: Congressional Research Service, March 5, 2012)

²⁹ Defense Industry Daily. *Aging Aircraft Cracks in USA's F/A-18 Fleet*. September 6, 2011. <http://www.defenseindustrydaily.com/Aging-Aircraft-Cracks-in-USAs-FA-18-fleet-05131/>

³⁰ Norman Friedman. *Unmanned Combat Air Systems: A New Kind Of Carrier Aviation*. Annapolis, MD : Naval Institute Press, 2010. 59

³¹ Ronald O'Rourke. *Navy Littoral Combat Ship (LCS) Program: Background and Issues, and Options for Congress*. CRS Report for Congress RL33741. (Washington DC: Congressional Research Service, March 20, 2012), 5-6

³² Ronald O'Rourke. *Navy DDG-51 and DDG-1000 Destroyer Programs: Background and Issues for Congress*. CRS Report for Congress RL32109. (Washington DC: Congressional Research Service, March 16, 2012), 4

³³ Ronald O'Rourke. *Navy DDG-51 and DDG-1000 Destroyer Programs: Background and Issues for Congress*. CRS Report for Congress RL32109. (Washington DC: Congressional Research Service, March 16, 2012), 5

³⁴ <http://www.navy.mil/navydata/fact.asp>

³⁵ <http://www.navy.mil/navydata/fact.asp>

³⁶ Ronald O'Rourke. *Navy Virginia (SSN-774) Class Attack Submarine Procurement: Background and Issues for Congress*. CRS Report for Congress RL32418. (Washington DC: Congressional Research Service, March 1, 2012), 6

³⁷ <http://www.navy.mil/navydata/fact.asp>

³⁸ Gordon, 54-55

³⁹ Robert Parley, "Over the Horizon: Symbol and Utility in The Great Carrier Debate," *World Politics Review*, (11 May 2011), www.worldpoliticsreview.com/articles/8807/over-the-horizon-symbol-and-utility-in-the-great-carrier-debate. Quoted in Christopher Murray "The Supercarrier is NOT Superfluous" *Proceedings* 137.9 (September 2011) pg 28-32 <http://www.proquest.com>

⁴⁰ Christopher Murray. "The Supercarrier is NOT Superfluous" *Proceedings* 137.9 (September 2011) pg 28-32 <http://www.proquest.com/>

⁴¹ Christopher Murray. "The Supercarrier is NOT Superfluous" *Proceedings* 137.9 (September 2011) pg 28-32 <http://www.proquest.com/>

⁴² U.S. Congress House. Committee on the Armed Services. *Tactical Air and Land Forces Subcommittee. Navy, Marine Corps and Airforce Tactical Aviation Programs Hearing Before the Subcommittee on Tactical Air and Land Forces of the Committee on Armed Services*. 112th Congress 1st sess., March 15, 2011, 101

⁴³ <http://www.navy.mil/navydata/fact.asp>

⁴⁴ Naval Aviation Enterprise. *Naval Aviation Vision*. Arlington VA: Department of the Navy, January 2012. <http://www.cnaf.navy.mil/nae>, 27

⁴⁵ U.S. Department of Defense. *Unmanned Systems Integrated Roadmap FY 2011-2036*. Arlington VA: Department of Defense, 2011.

⁴⁶ Gordon, 19

⁴⁷ <http://www.navy.mil/navydata/fact.asp>

⁴⁸ Robert Parley, "Over the Horizon: Symbol and Utility in The Great Carrier Debate," *World Politics Review*, 11 May 2011, www.worldpoliticsreview.com/articles/8807/over-the-horizon-

symbol-and-utility-in-the-great-carrier-debate. Quoted in Christopher Murray “The Supercarrier is NOT Superfluous” *Proceedings* 137.9 (September 2011) pg 28-32 <http://www.proquest.com/>

⁴⁹ Stansfield Turner. “Aircraft Carriers Are On Their Way Out” *Proceedings* 132.7 (July 2006) pg 16-18 <http://www.proquest.com/>

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