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THE FUTURE OF AIRCRAFT CARRIERS

Robert C. Rubel

The aircraft carrier has been around in various forms since the First World War. Its emergence as the key denominator of naval power is legendary, and its continuing prestige in this role is even yet spawning building programs among established and growing navies. The aircraft carrier is the largest and most complex of all warships and in most cases the most expensive. In addition to the cost of the ship itself, that of the embarked air wing must be considered, not to mention the extensive logistics and training infrastructure needed to keep carriers operating and useful. A recent Naval Postgraduate School study has shown that approximately 46 percent of the Navy's personnel—officer, enlisted, and civilian—are assigned to positions either on or supporting its carriers.¹ For these and other reasons, there has been almost constant debate over the past ninety years within navies, between navies and air forces, and within governments over the advisability of investing in carriers. As the prospects for major cutbacks in defense spending loom, the debate will again heat up. Both proponents and opponents of carriers have refined their arguments over the past nine decades, but these are now starting to wear thin as the geopolitical environment and the technology of war have changed. Also, the arguments both for and against have tended toward the theological, with many tacit or unacknowledged assumptions underpinning the argumentative maneuvers. In an attempt to improve the quality of the coming debates, this article will examine the prospects for future utility of the ship type, including that of the embarked air wing, from a different angle. Instead of making a holistic judgment on the future utility of aircraft carriers, it will focus on the ways they have been, are, or could be used.

Within the bounds of security classification, it will also attempt to sort out the risk factors that attend their use. Others may then proceed to decide whether a continued investment in them is justified.

In order even to begin to analyze the future of aircraft carriers, a definition of the type is warranted. It is easy to accept that the imposing, nuclear-powered *Nimitz*-class carriers (CVNs) of the U.S. Navy are truly aircraft carriers, operating as they do robust mini-air forces of sixty to eighty tactical jets and support aircraft. Similarly, the French *Charles de Gaulle* and the Brazilian *São Paulo* are clearly aircraft carriers, if significantly smaller. The former Russian *Varyag*, now being refurbished by the Chinese, is also clearly an aircraft carrier, meant as it is to handle fixed-wing jets as well as helicopters. There are a number of similar ships around the world that are meant to support operations of short-takeoff/vertical-landing (STOVL) jets. However, the definition becomes less clear in the case of ships that are capable of supporting STOVL jets but whose stated purpose is either amphibious assault (the U.S. *Wasp* and *Tarawa* classes, for example) or antisubmarine warfare (the Japanese *Hyuga*-class “destroyers,” which have ship-long flight decks).² Principally, though these latter ships are designed to operate helicopters, they could have—and they have in fact—operated STOVLs. However, despite their ability to operate STOVL jets, these ships cannot be considered true aircraft carriers, since, as will be seen, they cannot adequately perform the doctrinal roles that aircraft carriers have historically fulfilled.

A SHORT DOCTRINAL HISTORY OF AIRCRAFT CARRIERS

Most histories of aircraft carriers focus on the progressive development of their physical characteristics and their performance in battle. However, in order to understand the issues that will influence their future, it is necessary to understand how the doctrinal roles of aircraft carriers have evolved. Since navies in general and the U.S. Navy in particular do not publish doctrine along these lines, it is necessary to infer it from the way the carriers have been used.

The normal way to discuss doctrinal roles of aircraft carriers is in terms of “sea control” and “power projection”—this terminology being congruent with the way the U.S. Navy describes its strategic missions. However, these terms are too broad and indiscriminate to allow clear analysis of the strengths and weaknesses of aircraft carriers. Power projection could mean either one-time strikes or sustained, “level of effort” operations to prosecute air campaigns against enemy infrastructure or in support of ground forces with interdiction and close air support. However, it makes a critical difference whether operations against land require a carrier to constrain its movements or not. Thus terms like “power

projection” and “strike,” and even “sea control,” are too broad to be useful in this discussion. For the purpose of this article, they are subsumed, as appropriate, within the roles described below.

The six doctrinal roles aircraft carriers have performed are presented below in roughly the order they were adopted.

Eyes of the Fleet. In their earliest instantiation in the U.S. Navy, aircraft carriers were conceived of as platforms whose aircraft would be used to locate the enemy fleet before it broke the horizon so that one’s own battle line could maneuver to engage at best advantage. Once the battle lines were engaged within visual range, aircraft would spot the fall of shot, adjusting the fire of major-caliber guns more quickly and accurately and at longer ranges than could observers high in the battleships’ masts. In this role, the carrier would operate with its own fleet’s battle line interposed between it and the enemy; without substantial defense of its own, the carrier could not be subjected to risk. Its air wing would consist almost solely of scout planes, which was appropriate in view of the limited performance of the aircraft of the day. However, it did not take long to realize that the advantages of aircraft scouting and shot spotting were so great that an opposing fleet would obtain its own carriers and embark on them fighters to shoot down scouts. Thus carriers quickly became homes to fighter aircraft that could fight for and win air superiority over the enemy fleet so that the scouts could do their mission.

Cavalry. In some of the fleet battle experiments in the 1930s and throughout most of World War II, the carriers took on the mission of conducting hit-and-run raids, the most famous of which was the Doolittle raid on Tokyo in early 1942.³ Operating in a manner not unlike the cavalry of Confederate general Nathan Bedford Forrest in the Civil War, the fast carriers depended on speed and stealth to sneak into waters in which the Japanese fleet held sway in order to attack bases and otherwise disrupt enemy logistical operations. In this role, the carriers could not risk getting into a decisive engagement, any more than a Civil War cavalry brigade could risk becoming snared in a dismounted fight with infantry.

Capital Ship. A “capital ship,” rightly understood, is a ship type that can defeat any other ship type. In the days of sail and dreadnoughts, it was the type of ship having the most and biggest guns. It is the ship type around which fleet doctrine and fleet architecture are established. The question is what kind of killing weapon the capital ship supports. In the early 1920s, as naval aviation was gestating, it became clear from war games at the U.S. Naval War College that if aircraft performance kept increasing, a coordinated attack by carrier aircraft with

armor-piercing bombs could sink a battleship before it ever got in range of one's own fleet. This notion was validated by the Japanese attack on Pearl Harbor and by the sinking of two British dreadnoughts by Japanese land-based aircraft. Subsequently, the great carrier battles of the Pacific determined the outcome of the war as much as great sailing-ship battles had those of earlier conflicts. Used as capital ships, the acceptable risk profile for aircraft carriers changes substantially—they become consumables, just like any other capital ship. However, in subject-

Even if it does not build another carrier after USS Ford, the United States will have nuclear carriers around for at least the next fifty years.

ing themselves to risk they must be able to inflict such harm on the main enemy force that it is not capable of further contesting “command of the sea” at an acceptable

level of risk to itself. Since the battle of Leyte Gulf, carriers have not been used in this role.

When nations commit their capital ships to a battle, it is generally for command of the sea, having achieved which, by virtue of defeating and seriously weakening the opponent's main fleet, a force may use the seas for its own strategic purposes. Fighting for sea control in specific instances may still be necessary. The carrier battles of World War II were generally aimed at securing command of the sea; however, the carriers still had to function as local sea-control platforms, a role in which they were very effective. However, it should be noted that as the American fleet approached the Japanese home islands, threats from land-based defenses required ever greater concentrations of carriers to secure sufficient control of the sea to allow amphibious operations to take place.

Nuclear-Strike Platform. The advent of nuclear weapons caused significant turmoil within the U.S. military establishment. The newly independent Air Force argued that its intercontinental nuclear bombers made aircraft carriers obsolete. The Navy, for its part, sought to defend the carrier force by making it a part of the nation's nuclear war plans and deterrent posture. As a nuclear delivery platform, the carrier would operate a bit as it did in the cavalry role, depending on speed and stealth to reach a point at which it could launch its nuclear bombers. After that launch, it would attempt to survive as best it could, either to get back to the United States or to be ready for additional tasking. The point is that in this role, just as in the cavalry and capital-ship roles, its mode of operation was to deliver a pulse of power and then scoot—standing and fighting was a recipe for destruction. Keeping risk acceptable was a function of the ability to stay unlocated and untargeted. The ballistic-missile nuclear submarine replaced the aircraft carrier in this role because the risk of it being found before it could fire its missiles was all but eliminated.

Airfield at Sea. Three traditional rules govern how a fleet should be employed:

1. Keep the fleet concentrated.
2. Do not tie a mobile fleet to a piece of ground.
3. Do not become decisively engaged with land forces unless decisively superior.

These rules can be violated, but the conditions have to be right—namely, there can be no significant opposition at sea. In order to support a ground fight ashore or conduct a continuous air campaign (power projection in the “level of effort” mode), aircraft carriers have to break at least rules 2 and 3, and in order to maintain a carrier on station for months or years, as was done in Vietnam, they must break rule 1. The requirement to feed aircraft continuously into a land fight essentially robs the aircraft carrier of its maneuverability, due to the relatively short range of carrier-borne tactical jets. During the wars in Korea and Vietnam and all operations since the fall of the Soviet Union, in the almost complete absence of at-sea opposition, U.S. aircraft carriers have operated exclusively in this role. The one exception was the U.S.-Soviet face-down in the eastern Mediterranean in conjunction with the 1973 Yom Kippur War between Israel and an assortment of Arab powers. In that crisis, three American carrier groups were positioned to be ready to assist the Israelis with land strikes. Meanwhile, the numerically superior Soviet Fifth Eskadra positioned itself to sink or disable the carriers.⁴ This represented a fundamental paradox in doctrinal roles for the carriers, and they faced tactical defeat had hostilities broken out, having insufficient sea room to maneuver so as to adopt a capital-ship posture. The key to using carriers in the “airfield at sea” role is to take explicit account of their inability to tolerate much risk at all.

Geopolitical Chess Piece. It has been the habit of American presidents and their advisers in the gamut of crises since World War II to move aircraft carriers around to demonstrate American concern, resolve, or outright anger. The particular benefits of using carriers in this way are that they operate on the high seas, where permission to move is not needed from other countries, and that because they carry their own fuel, weapons, and maintenance, they are ready on arrival at the scene of a crisis to deliver power. Moreover, since modern U.S. carriers are large and imposing, and have been unchallenged on the seas, they “show the flag” to great effect—they provide excellent “visuals.” Here too, however, precisely because they need to be visible in this role, and because they normally must be ready to function also as an airfield at sea, carriers cannot tolerate any significant risk. This was the difficulty in the Yom Kippur War crisis mentioned previously. The Navy and the nation are so used to operating carriers

with impunity as airfields at sea that as new sea-denial threats emerge (as did the Soviet navy) the potential for a role/risk disconnect is magnified.

Another definition of “capital ship,” though not unrelated to its operational definition, is that of a ship type whose power, expense, and prestige are so great that it becomes the yardstick for measuring a nation’s naval power. This definition is essentially a different slant on the “geopolitical chess piece” role. This view arose especially during the age of dreadnoughts, when the Washington Treaty attempted to rein in naval arms races by formally limiting the tonnage of battleships.⁵ Aircraft carriers became the objects of this type of thinking, and this is one of the reasons that a number of emerging navies, as well as established navies under pressure from shrinking budgets, are electing to devote higher proportions of their resources to building them.

However, for the United States, this thinking could become a geopolitical trap. The *Nimitz*- and *Ford*-class carriers are built at only one yard, in Newport News, Virginia. Currently, they are being built at the rate of one every five years, in order to maintain the Navy’s inventory of them at eleven. One of these carriers, including its air wing, costs about as much as ten nuclear submarines or almost twenty guided-missile destroyers. When debates arise about how many carriers this nation really needs, one of the arguments employed to oppose reductions is that if it does not keep building these ships, it will lose the workforce needed to construct them. Not having the capability to construct a large nuclear-powered carrier would, some argue, put the nation at strategic risk. However, this line of reasoning seems to be based more on the general notion that carriers represent national strength than on any specific strategic or operational necessity. Even if it does not build another carrier after USS *Ford*, the United States will have nuclear carriers around for at least the next fifty years. It does not seem reasonable to presume that the strategic future of the United States hinges on a few thousand shipyard workers in Virginia.

OTHER ROLES FOR AVIATION SHIPS

In World War II, the majority of the aircraft carriers the United States built were termed “escort carriers.” These small ships could carry only a few aircraft and were used mostly for antisubmarine (ASW) work or for air support of amphibious operations. Because of their limited capacity and slow speed, they could not be adequately used in any of the six doctrinal roles outlined above. In the 1950s, a number of World War II fast carriers of the *Essex* class were converted to antisubmarine carriers. These ships carried mostly sub-hunting aircraft, with a few jets for self-defense. Other *Essexes* were turned into helicopter carriers, for helo-borne assaults over the beach. Once these ships had passed their useful service lives, vessels designed from the keel up as helicopter carriers were put into

service; progressively newer designs have entered the fleet ever since. Some new versions of the through-deck aviation ship now complicate the matter of designation. The recently commissioned Spanish “strategic projection ship” *Juan Carlos* would seem to blur doctrinal boundaries, because it features a “ski jump” for operating STOVL jets. Nevertheless, the ship’s design focuses on amphibious operations more than any of the doctrinal roles mentioned above.

Aside from ship designs or conversions with specific mission focuses of ASW or amphibious assault, regular aircraft carriers, by virtue of their inherent flexibility, have been pressed into service in a number of collateral missions in recent years, most prominently disaster relief and humanitarian assistance. In this mode they mostly operate helicopters, although other aspects of their capability come into play, such as communications, freshwater distillation, and medical capacity. It is worthwhile noting at this point that the impetus behind the forthcoming new Chinese aircraft carrier may have been more frustration at inability to participate in the 2004 tsunami relief effort in Indonesia (where the *Nimitz*-class carrier USS *Abraham Lincoln* played a key part) than a desire to face down American carriers.

In considering the future of aircraft carriers, we should understand that aviation-capable ships engaging in specialized or collateral missions will always be needed to some extent. Whether ships used for these purposes look like aircraft carriers or not, the calculus for the advisability of building them will be different from that which governs true aircraft carriers.

THE IMPACT OF FUTURE TECHNOLOGY

Armed with an understanding of their doctrinal roles, we can proceed to assess how current and future weapons and systems technologies might affect the utility of aircraft carriers. It is a matter not simply of whether the carrier can be defended or not but of whether it can fulfill the doctrinal role the nation requires of it.

Antiship Ballistic Missiles. Professional journals have been full of articles analyzing the potential impact of the recently developed Chinese DF-21F intermediate-range ballistic missile, fitted with a maneuvering reentry head that has an anti-ship seeker built into it. The purpose of this missile is thought to be not so much to sink the carrier as to achieve a “mission kill,” causing fires and damage to the air wing and topside structures. If the missile system is perceived to be effective at this, then its existence and the presence of its mobile transporter/erector/launchers would constitute a deterrent to U.S. interference in an invasion of Taiwan or in other Chinese initiatives within about a thousand miles of China’s coast. Assuming that a terminal, hit-to-kill defense is not feasible against it, this

missile would seem to threaten seriously the future utility of the aircraft carrier anywhere within its range. On the other hand, having a seeker, it could be vulnerable to decoying. If this is the case, the probabilities for missile success are reduced. This leads us to think in terms of what role the carrier might be playing as it sails into DF-21 threat range. If the carrier is functioning as cavalry, a capital ship, or a nuclear-strike platform—that is, delivering a pulse of power and then escaping—the risk tolerance inherent in those roles might be compatible with the reduced but still significant threat posed by the DF-21. If, however, the carrier is being used as either an airfield at sea or a geopolitical chess piece, its mobility sacrificed and the risk incurred likely would be incommensurate with the role.

Submarines, Antiship Cruise Missiles, and Other Access-Denial Systems. The effect of these systems is similar to that of the DF-21. Current and anticipated defensive systems for the carrier are likely to be able to handle small numbers of these weapons. However, when larger numbers are employed against the carrier—and this will probably only happen in littoral waters—the likelihood of “leakers” increases. Once again, depending on the role the carrier is playing, the risk may be tolerable, especially if the carrier is free to maneuver. If a combination of geography and doctrinal role constrains its mobility and maneuverability, the risk climbs quickly.

Some have advocated, on these grounds, that smaller carriers ought to be built in larger numbers to achieve “tactical stability,” the condition in which the defensive capabilities of the ship and its contributions to the overall offensive power of the force are in balance. Games at the Naval War College have cast some doubt on this logic, quite apart from considerations of the relative efficiency of large and small flight decks. It appears that doctrinal role is a governing factor. In general, it seems that if mobility is compromised by doctrinal role, the net risk to the force is the same, whether the force is composed of one or two large, or four to six small, carriers. Nothing changes, except in the inefficiencies and added cost of multiple small carriers.

Improved Air-Defense Systems. In one important sense, the viability of tactical airpower is the essence of the future utility of aircraft carriers. New types of surface-to-air missile systems have made operation of nonstealthy aircraft within their range excessively risky. Also, new generations of fighters, notably the Su-27, its derivatives, and even newer designs from Russia and China, have eroded the technical advantages traditionally enjoyed by American aircraft. New types of air-to-air missiles, fighter radars, and sophisticated crew/system interfaces have similarly lessened the advantage our superior training has conferred. All of this calls into question the utility of aircraft carriers as strike (cavalry) platforms or airfields at sea against a well armed opponent. The same trend holds in the arena of war at

sea, at least with respect to surface-to-air missiles, and may compromise the viability of the aircraft carrier in the capital-ship role. To fight modern, high-tech air defenses, sea or land based, missiles may be the only viable answer, although very stealthy unmanned aircraft operating from aircraft carriers may also be viable, especially if equipped with short-range attack missiles.

Short-Takeoff/Vertical-Landing Jets. The advent of the F-35B STOVL Joint Strike Fighter (JSF) promises to enhance significantly the overall capabilities of a ski jump–equipped carrier. The question is whether this increase in capability would both allow such smaller aviation-capable ships to function as regular aircraft carriers and change the calculus of the various doctrinal roles. It appears that the F-35B will offer increases in range and load-carrying capability over the AV-8 Harrier, the British-developed “jump jet” that has served a number of navies and the U.S. Marines for decades. However, these increases do not come close to bringing the F-35B into the same class as conventional-takeoff-and-landing carrier aircraft, and the range and endurance of even these are short enough to require the carrier to get in rather close to the fight. The principal advantages of the F-35B will be its increased connectivity, sensing, and stealth—all good things, but not sufficient to change the logic inherent in the doctrinal roles. Moreover, the small number of aircraft that can be carried on the ski-jump carriers limits their ability to perform some of the doctrinal roles. They will likely remain useful support ships for amphibious and antisubmarine operations, especially operating helicopters, and will constitute prestige platforms for small navies to show the flag.

Unmanned Aircraft (UAVs). What could potentially change the calculus of doctrinal roles is the unmanned aircraft. For a given “deck spot” (the square footage an aircraft takes up parked on a carrier’s flight or hangar deck), unmanned aircraft offer double or triple the range and endurance of manned aircraft. Moreover, without the need to accommodate a human, their form can be considerably more stealthy, and their operations do not need to take into account crew-rest factors, at least to the extent that they do in manned aircraft. What this may offer in terms of doctrinal roles is a return of the carrier as the eyes of the fleet, operating a wing of long-range UAVs for reconnaissance and perhaps line-of-sight communications relay. A carrier could then remain outside most threat “envelopes,” with much more scope for maneuvering to keep from being targeted. The longer range of UAVs (including unmanned combat aerial vehicles, or UCAVs) would also allow the carrier to function as an airfield at sea with less risk. In terms of command and control, however, UAVs that require a constant “man in the loop” would not offer as much flexibility to the carrier as those with higher degrees of autonomy.

FUTURE DOCTRINAL ROLES

The traditional rationale for aircraft carriers is that they provide tactical airpower independent of land bases and that—no small thing—they are ready to do so on arrival. While all of this is true and constitutes concrete benefits of having aircraft carriers, the real arguments for and against them reside in their doctrinal roles. Which of the traditional roles are obsolete? Do the remaining ones justify continuing investment in aircraft carriers? Are there emerging or potential roles for carriers that would justify building more?

As has been mentioned, the development of unmanned aircraft may revitalize the primordial role of aircraft carriers as eyes of the fleet. Operating a wing of various kinds of UAVs, the carriers could conduct what is known as C4ISR (command, control, communications, computers, intelligence, surveillance, and reconnaissance) or establish a grid of airborne relay nodes that would support a fleet battle network if satellites were destroyed or intense jamming occurred. Because of the vulnerability of land bases to ballistic missiles, and at increasing distances from potential war zones, the arguments that the Navy has used in the realm of tactical airpower to justify carriers also serve for carrier-based C4ISR. As with tactical airpower, regardless of how long aircraft range is and how much in-flight refueling is available, if land bases are distant from the area of operations, it takes far more aircraft to generate a continuous presence in the battle space and operations are far less responsive and flexible than they would be if based from a nearby carrier. A local source of UAVs, if land bases are far away, is invaluable operationally and strategically.

The cavalry role for carriers, practiced as late as the 1986 EL DORADO CANYON strikes on Libya, has become a victim of the missile age. In the most recent round of strikes on Libya, Tomahawk cruise missiles were used. Now possessing guided-missile submarines that can carry over a hundred Tomahawks, the Navy does not have to accept risks of running a carrier surreptitiously into hostile waters to carry out a strike or subjecting manned tactical aircraft to robust air defenses. In a similar manner, the introduction of the ballistic-missile submarine made the carrier nuclear-strike role obsolete. Whatever the trade-offs between tactical aircraft, manned or unmanned, and missiles, the lethality of modern air defenses and the difficulty of moving naval forces undetected militate strongly against using carriers in this role. It does not appear that a carrier operating UCAVs would offer any significant advantage in the cavalry role over a submarine carrying cruise missiles.

As for the capital-ship role, in the missile age the whole concept may be obsolete. There has been a constant ebb and flow of technical and tactical superiority of the offense and defense at sea, but mostly the offense now dominates—modern antiship missiles are very fast and hard to shoot down. Certainly, they

are dependent on the successful functioning of their seeker heads; these can be decoyed or blinded, and the prospect of close-in directed-energy defenses may tilt the balance in favor of the defense.⁶ However, a successful defense of the carrier does no good if the carrier cannot in turn succeed in attacking enemy naval forces. Improvements in air-defense technology by Russia and China and the prospects for their proliferation will make the tactical offense progressively more difficult and risky. It should be recalled that in the great carrier battles of World War II, the aircraft losses were brutal, on the order of 70 percent for the

Used as capital ships, the acceptable risk profile for aircraft carriers changes substantially—they become consumables.

Japanese and 28 percent for the Americans.⁷ In the late 1970s, as naval aviation developed aircraft-centric antiship tactics in the aftermath of the wake-up call of the

1973 episode, it became clear that a single strike on a single formation of Soviet ships might cost a quarter of an air wing.⁸ Whereas we were able to replace such losses in 1942–45, no such thing would be possible today, given the complexity and expense of modern jets.

The upshot is that the seas, at least certain areas of them, are becoming a no-man's-land for surface ships. Whether or not submarines ought to be considered capital ships is beside the point; the carrier will likely not be one. On the other hand, for scenarios short of high-end missile combat, there is no ship more able to exercise general control of a large ocean area than an aircraft carrier, fanning out its air wing to scout and identify surface vessels. Carrier aircraft probably are the best counter, for example, to the small-boat swarms that some countries, like Iran, have adopted, assuming the carrier can operate out of range of the densest littoral defenses.

Currently, the “airfield at sea” is almost the exclusive role for the large aircraft carrier, essentially fused with that of the “geopolitical chess piece.” This (combined) role will continue to be highly useful into the future, so long as the intensity of defenses stays below a certain threshold. If either high-tech air or naval defenses proliferate, the number of areas and scenarios in which carriers can function in this role will decline. If this happens, the value of the carrier as a geopolitical chess piece will erode proportionately. This is a key uncertainty about the future and a central difficulty in assessing the future value of aircraft carriers. If a ground fight occurs close to the coast and a carrier could move in with impunity to provide air support, perhaps through-deck amphibious ships flying STOVL aircraft would suffice. But their capacity to generate sorties and the number of targets they can strike are nowhere near what is possible for large carriers with catapults and arresting wires; moreover, if deep penetration is needed, as has been the case in Afghanistan, nothing less than a large carrier operating

conventional aircraft will do. Because of miniaturization, advanced electronics, and advances in missile, mine, torpedo, and submarine design, it is becoming easier to hide naval defenses. A particular case in point is the Club-K cruise missile marketed by the Russian company Novator. Four missiles could be housed in an innocuous-looking shipping container, hidden in plain sight and ready to be fired from trucks, railroad cars, or commercial ships.⁹ Similar advances in covertness can be expected in other weapons types. The implication is that it will be difficult or impossible to “sanitize” an area where a carrier can function as an airfield at sea.

What new doctrinal roles might emerge for the aircraft carrier? One that comes to mind is a variation on “eyes of the fleet.” If the struggle for sea control migrates to below the surface, an aircraft carrier might be highly useful as a submarine-support vessel. The carrier would not only provide C4ISR services for submarines but disrupt air and surface ASW efforts by the enemy, perhaps even conduct ASW itself. Especially if operating long-range UAVs, the carrier might be able to maneuver more widely and thereby perform this role at an acceptable degree of risk—or better put, at a level of risk commensurate with the doctrinal role.

Another potential supporting role for the carrier is as a mother ship for the littoral combat ship (LCS). The LCS has limited sea-keeping capability and must have a source of logistical support relatively close by, especially if it is to operate at high speed and high combat tempo. If a squadron of LCSs must enter a high-threat area where there are no bases and where regular logistical ships would be at excessive risk, a nuclear carrier might be the answer. Having considerable fuel and ammunition-storage capacity, high sustained speeds, and self-defense ability (with its escorts), a carrier could range around undetected or untargeted until a covert rendezvous with one or more LCSs could be arranged. While a logistical support system that employs submarines might be the ideal, this arrangement may be the most feasible in the short term. In conjunction with this role, the carrier, operating both manned and unmanned aircraft, could provide tactical scouting for littoral combat vessels as well as a secure and robust local battle network.

A NEW CALCULUS

This assessment of doctrinal roles is revealing. Certain roles for the carrier are already obsolete, and others are eroding. A few new roles are emerging, but these place the carrier in a new position in relation to the rest of the fleet. Whereas the carrier has been the central pivot of the fleet since World War II, the arbiter and yardstick of naval supremacy and the keystone of fleet architecture, it will gradually become a more narrowly useful role player. There will be, for the foreseeable

future, situations that demand an aircraft carrier, so it can be said with confidence that the ship type will be needed. However, the constriction in its roles and in the locations and circumstances in which it could be appropriately used (i.e., where doctrinal role and risk intersect) indicates that a new calculus is needed to determine how many the U.S. Navy really needs.

This article has dealt only obliquely with the issue of small versus large carriers. The author has served on both types and is convinced that nonnuclear ships under about eighty thousand tons sacrifice too much total combat capability to be worthwhile investments as aircraft carriers. On the other hand, aviation ships that can support operationally significant numbers of helicopters and STOVL jets will be useful in amphibious and antisubmarine operations as well as a host of others, including disaster relief, noncombatant evacuation, and various types of humanitarian assistance.

An embedded implication in all this for amphibious operations should be noted. If things are too hot to allow a carrier to operate as an airfield at sea, they are too hot for an amphibious assault. If the number of times and places a carrier can operate as an airfield at sea decrease, they decrease as well for amphibious operations. Any assumptions about the ability to “roll back” enemy defenses must be severely tempered by the likelihood that new technologies will produce weapons that can be hidden from preemptive strikes—like the improvised explosive devices and car bombs that have been such intractable problems in Afghanistan and Iraq. There is no question that some capacity for amphibious operations from the sea will be needed in the future, but a rigorous and objective analysis of the number of times and places in which they would be possible is warranted, and as with carriers, a new calculus for sizing that capability is needed.

Another key consideration that would govern carrier force structure is deployment posture. Since World War II, the United States has maintained a forward-deployed posture for the Navy, at times severely stressing its capacity. The Navy has found that for each carrier it wants to keep forward, it needs two additional ones to account for crew deployment tempo, training, and maintenance requirements. In theory, then, any carrier force level ought to be divisible by three. However, an additional carrier is needed to compensate for the extended yard periods required for nuclear refueling. That adds up to ten CVNs, but Congress has legislated that the Navy maintain eleven, the “extra” carrier being available for surge operations. There is currently a carrier homeported forward in Japan, which provides additional scheduling flexibility. In practice, however, the demand for carriers by the combatant commanders, coupled with the Navy’s Fleet Response Plan deployment scheme (which seeks to maximize the number of carriers available for surge operations), makes even eleven carriers seem insufficient. But the increasing expense of tactical jets and delays in their development,

as exemplified by the JSF, means that there will not be enough aircraft to populate eleven flight decks adequately, let alone a higher number.

In the future, as the doctrinal roles of the aircraft carrier change and become more narrowly defined, the number of carriers needed forward at any time may decline. Using the reverse of the standard Navy calculus, for every carrier not needed to be stationed forward, the total inventory could, in theory, be reduced

Both proponents and opponents of carriers have refined their arguments over the past nine decades, but these are now starting to wear thin.

by three. The savings would be enormous, and, if this analysis of doctrinal roles is correct, there would be no reduction in the overall war-fighting effectiveness of the Navy, assuming the money

saved could be reinvested, at least in part, in missiles, submarines, and surface ships. On one hand, a reduction of one carrier on station would take the Navy to a force of eight CVNs. On the other hand, if new doctrinal roles do materialize, a higher number of carriers may be warranted. USS *Enterprise*, the first nuclear carrier, commissioned fifty years ago, is on a forward deployment as this article is written. There is no reason to think that the *Nimitz*-class carriers will have shorter service lives, and the newer ones may last even longer. There is at least reason to think that a number of these ships will outlive the utility of any given type of embarked aircraft. This makes it difficult to assess the return on investment of additional new construction beyond *Ford* or its follow-on ship. If the possible doctrinal roles for the aircraft carrier become too risky or are significantly constrained in terms of where and when they might be feasible, the value of so expensive a platform will be called into question.

The purpose of this article has been to explore the future of the aircraft carrier using the framework of doctrinal roles. It appears that despite changing technology there will be a continuing need for the ship type, although the obsolescence of some doctrinal roles and the anticipated constriction of its use as an airfield at sea may limit the numbers that are justified. New doctrinal roles may emerge, depending on the flexibility of mind shown by the naval aviation community. However, even if these new roles do pan out, they may not justify significantly greater numbers of ships. Moreover, the carrier's day as the supreme arbiter of naval power and the determinant of fleet architecture may be coming to a close. Its continuing utility will increasingly be in support roles. Once this shift occurs, it may actually be easier to arrive at an objective determination of numbers required, as much of the emotional and political baggage surrounding them will have been shed.

If we mark the emergence of the aircraft carrier as sovereign of the seas at the British carrier strike on the Italian fleet at Taranto in 1940, we see that the carrier has enjoyed a period of dominance of over seventy years, substantially longer than that of the dreadnought. To paraphrase Yogi Berra, the future of the aircraft carrier isn't what it used to be, but it is fairly clear the type will be around more than long enough to celebrate a century and a half of service.

NOTES

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1. Juan Carrasco [Lt., USN], "A Manpower Comparison of Three U.S. Navies: The Current Fleet, a Projected 313 Ship Fleet, and a More Distributed Bimodal Alternative" (master's thesis, U.S. Naval Postgraduate School, Monterey, Calif., 2009), p. xvii, available at edocs.nps.edu/.
2. See Vice Adm. Yoji Koda, "A New Carrier Race? Strategy, Force Planning, and JS Hyuga," *Naval War College Review* 64, no. 3 (Summer 2011), pp. 31–60.
3. For the interwar exercises see Albert A. Nofi, *To Train the Fleet for War: The U.S. Navy Fleet Problems, 1923–1940* (Newport, R.I.: Naval War College Press, 2010).
4. See Lyle Goldstein and Yuri Zhukov, "A Tale of Two Fleets: A Russian Perspective on the 1973 Naval Standoff in the Mediterranean," *Naval War College Review* 57, no 2 (Spring 2004), pp. 27–63.
5. Aircraft carrier tonnage too was limited by the treaty, indicating that the carrier had already become identified as a type of capital ship.
6. Obscurants might do so as well, as argued by Thomas J. Culora, "The Strategic Implications of Obscurants: History and the Future," *Naval War College Review* 63, no. 3 (Summer 2010), pp. 73–84.
7. Wayne Hughes, *Fleet Tactics and Coastal Combat* (Annapolis, Md.: Naval Institute Press, 2000), pp. 102–106.
8. The author was a weapons and tactics officer in the A-7 community at that time; this assertion is based on personal experience in both planning and conducting exercise strikes.
9. It should be noted that Russian officials have denied that these missiles could be launched from a shipping container. See "Club-K Container Missile System," *Kontsern Morinformistema-AGAT*, www.concern-agat.ru/, for the company's position. It is interesting, however, that the company has used in its advertisements web videos of the missile being fired from shipping containers.



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