

In Brief: The Logic of Aircraft Carrier Strike Groups

This assessment provided the read-ahead for a recent carrier strike group working forum hosted by the Lexington Institute.



**Loren Thompson
Lexington Institute
September 2019**

Global Trends Are Strengthening The Case For Carrier Strike Groups

The United States is the only nation in history that has sustained a fleet of large-deck, nuclear-powered aircraft carriers. “Large-deck” means the carrier has over four acres of deck space, enough to support a carrier air wing of 75 or more aircraft. “Nuclear-powered” means the carrier has unlimited range and endurance, requiring refueling only once during its 50-year service life.

Current law requires a fleet of at least 11 such carriers, enough to support forward deployment of three to four carriers in the seas around Eurasia at any given time, and more during crises. Carriers typically operate in “strike groups” of several warships, with the carrier providing most of the offensive punch while surface combatants and submarines provide defense against overhead, surface and undersea threats.

Large-deck carriers of the Nimitz and Ford class can sustain more than a hundred aircraft sorties per day, surging to over twice that number in wartime. With each strike aircraft capable of accurately delivering multiple smart bombs per flight, a carrier air wing can disable or destroy hundreds of targets in a single day.

The Ford class was designed to optimize the efficiency of the flight deck and is able to generate more flights per day than previous generations of aircraft carriers. This increased sortie generation rate is critical for success in a peer/near-peer competitor environment. Along with this increased sortie generation rate, the Electromagnetic Launch and Recovery System and Advanced Arresting Gear will enable use of heavier and lighter aircraft to augment the current air wing.

Air-delivered weapons can be used to reduce enemy assets ashore, or to establish sea control over vast areas of ocean including vital chokepoints. These objectives are achieved without requiring access to vulnerable land bases, and the continuous maneuvering of the carrier as it conducts air operations greatly complicates enemy efforts to attack it.

The latest version of U.S. national defense strategy focuses military efforts primarily on deterring or defeating aggression by Russia and China.

Carriers are likely to play a central role in this strategy for the foreseeable future because they enable continuous forward deployment of U.S. air power in areas where competing nations are most likely to seek military gains. That includes in particular the Western Pacific, which has become the heartland of the global industrial economy.

The United States today is more dependent on manufactured goods from offshore sources than at any other time in its history. Those sources typically are closer to China and Russia than America, so it is essential to secure the sea lanes and air space providing access to them. The Navy describes itself as “a key enabler of the Joint Force’s ability to prevent China and Russia from controlling the Eurasian rimland and its adjacent seas;” its current strategy goes on to state, “We will protect the sea lines of communication between the United States and its allies and partners.”

In order to do that, the Navy must be constantly forward deployed with sufficient firepower to sustain high-rate, precise attacks against threats. Furthermore, it must be able to survive combat despite operating near the main centers of Chinese and Russian military power. The balance of this brief explains why large-deck, nuclear-powered aircraft carriers offer capabilities essential to achieving these goals.



The Boeing F/A-18 E/F Super Hornet has proven to be the most successful strike aircraft in naval history, and also provides the airframe for the carrier air wing's EA-18G Growler electronic attack plane.

Aircraft Carrier Strike Groups Are Versatile

Aircraft carriers exist to provide mobile, forward basing of air wings containing 75 or more combat aircraft. A carrier air wing will typically include 44 strike fighters, a squadron of five electronic-warfare planes for jamming hostile radars and communications, a squadron of five radar planes for providing surveillance of local air space, and two squadrons of helicopters used in antisubmarine and countermine warfare.

Because the air wing contains a diverse assortment of advanced aircraft, it is capable of executing many different missions. These include:

- Highly accurate, sustained strikes against hostile land targets, both fixed and mobile.
- Surveillance of air space extending hundreds of miles in any direction from the carrier.
- Interception and destruction of hostile aircraft, both manned and unmanned, threatening friendly forces.
- Sea control of areas within which friendly naval forces are operating through engagement of hostile warships.
- Air cover and fire support of friendly ground forces executing military operations ashore.
- Suppression of hostile sensors and networks vital to effective warfighting.
- Preemption of enemy ballistic missiles and long-range anti-ship weapons.
- Protection of shipping, sea lanes and networks necessary for the unfettered conduct of commerce.
- Crisis response to threats caused by insurgents, terrorists and other irregular forces.
- Deterrence of diverse threats through forward presence and flexible response.

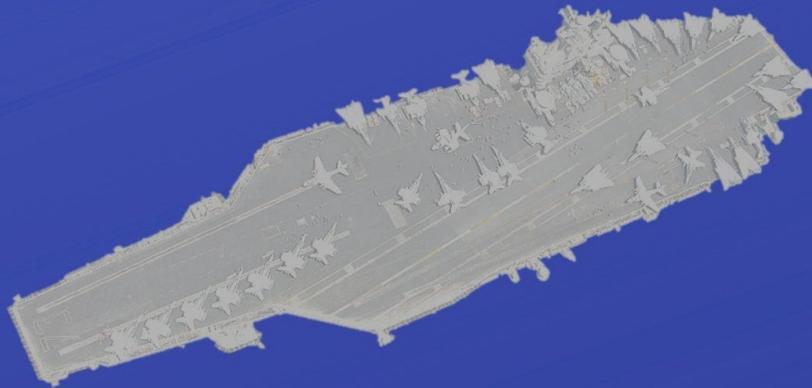
This is not a complete list, but it highlights the inherent versatility of sea-based air power equipped with modern munitions. Many of these missions could not be accomplished successfully with smaller-deck carriers hosting

lesser complements of aircraft. All of the missions are facilitated by the carrier's nuclear propulsion, which enables it to maneuver continuously while forward deployed. The versatility of large-deck, nuclear-powered carriers is further facilitated by the networking of naval and joint assets, so that the optimum sensors and weapons can be applied to any particular challenge.

THE CARRIER STRIKE GROUP



**TWO
DESTROYERS**



ONE SUPERCARRIER

**ONE
SUPPLY
SHIP**



**ATTACK
SUBMARINE
SUPPORT**



ONE CRUISER



Aircraft Carrier Strike Groups Are Survivable

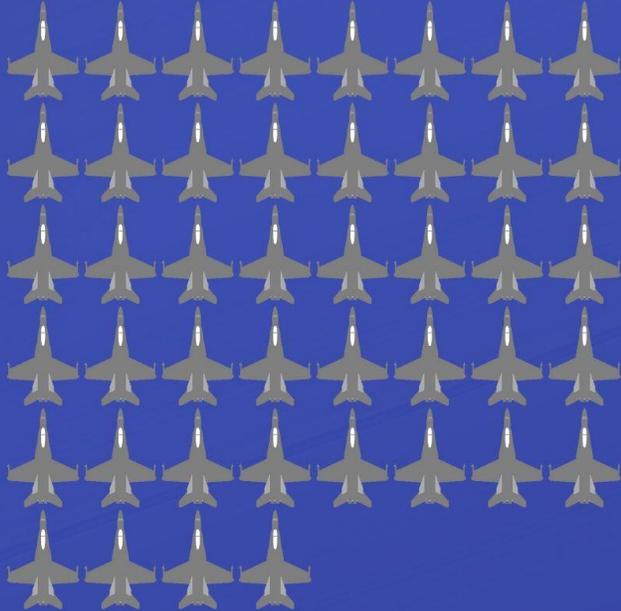
Large-deck, nuclear-powered aircraft carriers are the biggest warships ever built. Their size is directly related to the missions they must accomplish. Observers have long speculated that the size of carriers and the concentration of value they represent makes them vulnerable to attack, particularly when they are forward deployed near potential adversaries. However, the Navy believes that its aircraft carriers are less vulnerable now than at any time since World War Two began, and they are almost certainly less vulnerable than land bases.

In order for enemies to attack a carrier, they must successfully complete a complex sequence of events that the Navy calls a “kill chain.” First the carrier must be found; then its location must be fixed; then a track of its movement must be established; then the carrier must be engaged; and finally, the results of the engagement must be assessed. In practice, each of these steps consists of a series of subsidiary tasks. Like broken links in a chain, if any of the tasks in the kill chain is not accomplished in a timely fashion, the entire process breaks down.

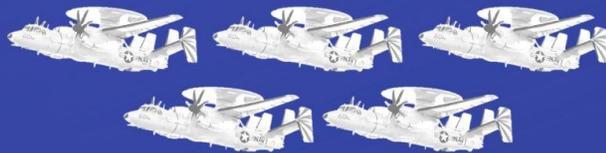
In the event of hostilities, the Navy plans to disrupt every step in an enemy’s kill chain, from strikes against sensors searching for carriers to jamming of enemy command links to interception of weapons seeking to engage the carrier. Several features of the carrier strike group severely impede any adversary’s ability to execute an effective attack:

- Carriers are always moving, so even if found they can disappear into hundreds of square miles of ocean within minutes.
- Carrier air wings can intercept and destroy enemy combat systems long before they get anywhere near the carrier.
- Carriers deploy with surface, air and undersea escorts that can defeat diverse overhead, surface and submerged threats.
- Carrier sensors are netted with those of other friendly assets to assure optimum detection and targeting of nearby threats.
- Carriers are nearly impossible to sink given their extensive armoring and hundreds of watertight compartments.

THE CARRIER AIR WING



44 STRIKE FIGHTERS



5 RADAR PLANES



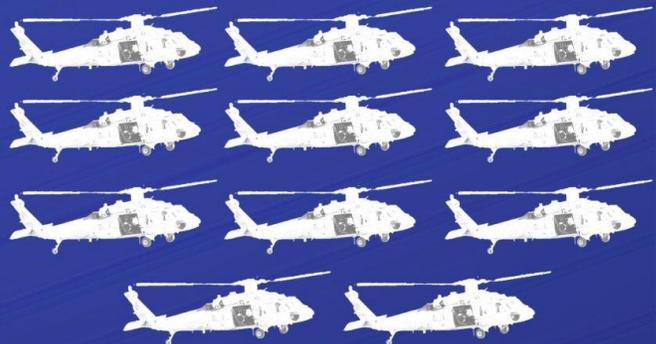
5 ELECTRONIC ATTACK PLANES



8 MH-60S HELICOPTERS



2 CMV-22B TILTROTORS



11 MH-60R HELICOPTERS

- Carriers are equipped with extensive on-board defenses against sea-skimming anti-ship missiles and other dangers.

Decades of planning and investment have surrounded today's carriers with a multi-tiered defensive perimeter that stretches out hundreds of miles in any direction. If circumstances dictate, the Navy can attack over-the-horizon radars within enemy territory, bases hosting anti-ship weapons, and even satellites in low earth orbit designed to track maritime targets. At present, no nation possesses an adequate satellite constellation to conduct continuous tracking of carrier battle groups – making long-range anti-ship missiles largely useless against carriers for lack of timely targeting coordinates.



An F-35C fighter conducts the first operational test of an AIM-120 air-to-air missile. The naval variant of the F-35 will increase the survivability, versatility and reach of carrier air wings.

Aircraft Carrier Strike Groups Are Affordable

Building the world's biggest warships, equipping them with dozens of aircraft, manning them and operating them along with various escorts is expensive. That is one reason why no other nation does it. However, analyzed in light of federal spending patterns and U.S. military missions around the world, aircraft carriers are not a major fiscal burden – even

large-deck, nuclear-powered ones. In fact, the annual cost of building, equipping and operating the Navy's 11 carriers probably is less than 1% of total federal outlays.

The Trump Administration's naval budget request for fiscal year 2020 was \$206 billion, representing about 4% of a \$4.7 trillion federal budget.

Carriers are only one part of the Navy budget, though, which must support the construction, manning and sustainment of a 300-ship fleet – including all the costs associated with the Marine Corps. Most of the surface and undersea fleet conducts operations separate from those of the carriers, only three or four of which are deployed on a typical day.

The cost of building aircraft carriers is not a significant factor in federal budget planning. Because carriers have a service life of 50 years, the Navy only needs to build one every five years to sustain its current fleet size. Construction of U.S.S. Kennedy, the second carrier in the Ford class, is expected to cost \$11.3 billion spread over seven years, a price-tag less than one day of federal spending at current rates. The cost of building the 75+ aircraft in the carrier's air wing and constructing escorts necessary for protection of the carrier would roughly double this price-tag to perhaps two days of federal spending spread over the better part of a decade.

A larger amount is required to operate and sustain carrier strike groups, including the costs of military pay, maintenance, resupply and midlife refueling. One estimate rendered by a respected naval expert suggests it costs \$6.5 million per day to operate a carrier strike group, a figure which includes pay for 6,700 sailors and the cost of acquiring all the ships in the strike group. Most of these costs will have to be carried whether the vessels are deployed, on training missions or in homeport. But even if costs are held constant regardless of ship status, the burden of owning and operating 11 carrier strike groups totals less than \$30 billion annually.

Calculating the fiscal burden of each carrier strike group is complicated, because assumptions must be made about items like the number of days deployed, the rate at which expendables are consumed, and what expenses the joint force might incur if it tried to accomplish missions without using

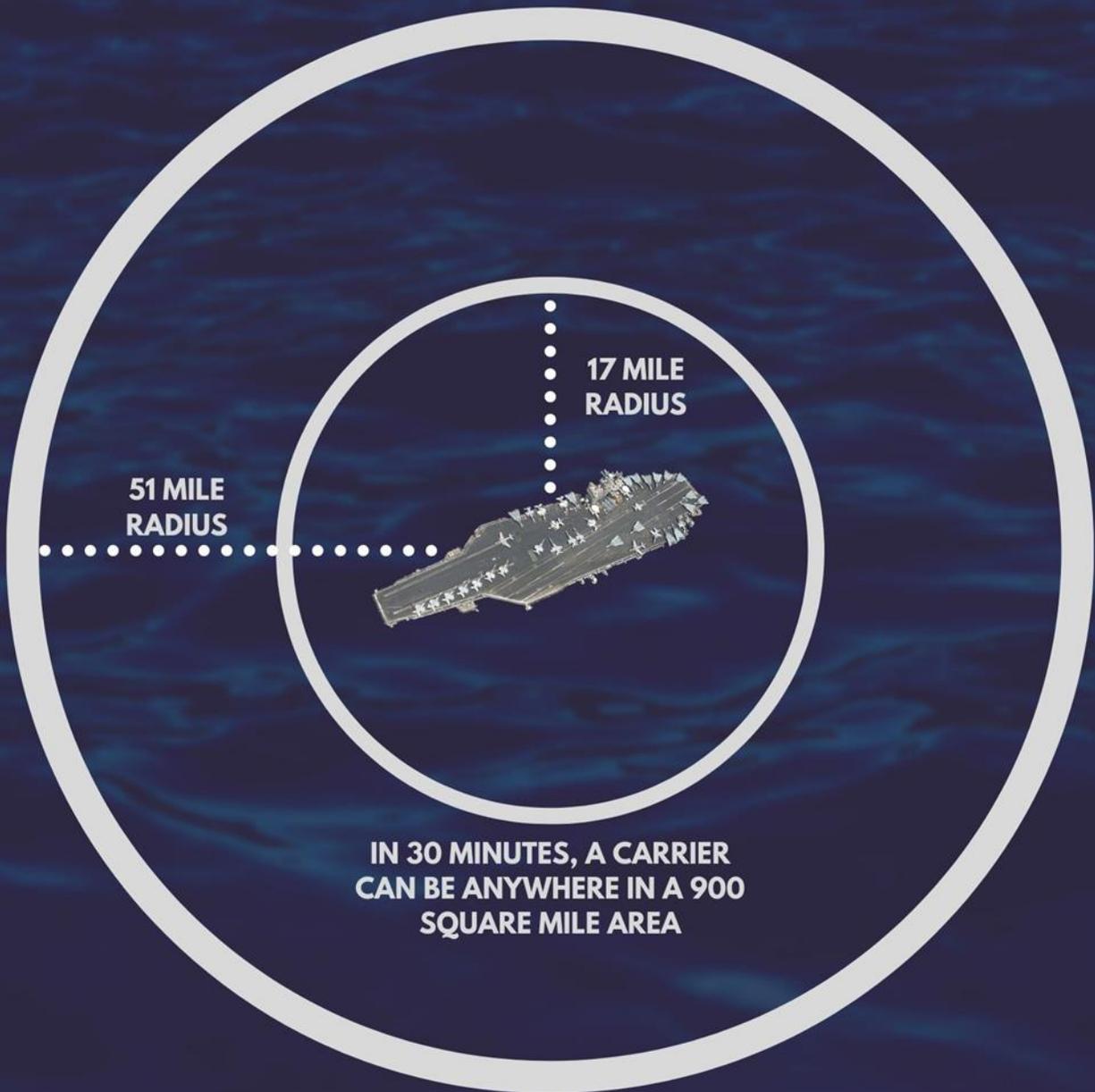
aircraft carriers. For instance, the challenge of executing strike operations against a major adversary without employing carriers would presumably require many more surface combatants and vast quantities of munitions that typically cost in excess of a million dollars per target destroyed. Carriers may actually be the least expensive way of accomplishing some missions critical to U.S. strategy.

Aircraft Carrier Strike Groups Are Indispensable

Every major threat to America's security since the republic was founded has originated in the land mass known as Eurasia. Whether the danger was imperialism, fascism, communism or terrorism, it always traced its source to somewhere in Eurasia. That remains true today, as national defense strategy transitions from a focus on violent extremism to deterring aggression by China and Russia. Eurasia is also the place where most of the world's people live and most of its commerce occurs – typically within a hundred miles of the ocean.

The United States is separated from Eurasia by vast oceans. These oceans traditionally have been the main conduit by which Americans traded with the rest of the world, and moved military forces to protect national security from emergent threats. Thus, securing transoceanic sea lanes is essential to U.S. interests for both economic and military reasons. Since World War Two, aircraft carriers have been by far the most cost-effective combat system for establishing sea control and projecting power into areas of Eurasia threatened by rivals.

CARRIER RANGE AT TOP SPEED



Five key features of large-deck, nuclear-powered aircraft carriers make them indispensable in containing threats to national security originating in Eurasia:

- They have unlimited range and endurance, enabling them to move 700 miles every day in whatever direction is needed.
- They have sufficient deck space, internal volume and power generation to support a large and diverse air wing.
- They do not require access to land bases, which may be unavailable in a crisis and are vulnerable to disabling attacks.
- They can sustain air campaigns against hundreds of land and/or maritime targets every day for months at a time.
- They are networked with other naval and joint assets to assure situational awareness and coverage of all threats.

The U.S. Navy has refined its concepts for applying aircraft carriers to sea control and power projection over nearly a century, gradually incorporating new technologies and tactics as threats evolved. Today, America's fleet of large-deck, nuclear-powered carriers is unique in the world, a visible commitment to the global security role Washington feels it must sustain. If carriers ceased to be part of the U.S. military posture, it is not clear how the joint force could accomplish many of the missions required by national strategy. All the available alternatives are likely to be less effective and thus less successful.



The Navy will replace fixed-wing carrier logistics planes with the more agile CMV-22 tiltrotor, enhancing the flexibility of the carrier air wing.

Deterrence Demands Capabilities That Carrier Strike Groups Deliver

In an address to Congress during his presidency, George Washington observed that preparing for war was one of the most effective ways of preserving the peace. That is the first known instance in which an American president endorsed what later came to be known as deterrence. Deterrence, simply stated, is a strategy of discouraging aggression by threatening unacceptable consequences. It has become the core precept of America's nuclear posture, and it shapes how U.S. conventional forces are trained, equipped and deployed.

U.S. aircraft carriers are deployed in forward locations near Eurasia as a visible symbol of America's determination to punish nations that would seek to upset the current international order. When crises loom, it has become routine to dispatch carrier strike groups as a way of influencing the thinking of potential aggressors. In many cases, carriers constitute the most

potent part of a conventional deterrence strategy aimed at preserving regional peace.

To be credible and thus persuasive, a deterrence strategy requires two things: a capability to inflict unacceptable damage, and a willingness to use that capability when necessary. Washington is deliberately vague about what circumstances will result in a U.S. military response, but the simple fact that naval and other forces are continuously deployed near potential aggressors will be sufficient warning of American willingness to act for many actors. When it comes to the warfighting capabilities required, though, carrier strike groups clearly have greater deterrence potential than most other components of the joint force.

For example, ground forces will not be effective in deterring aggression by China because there are few places where they can actually engage the People's Liberation Army, and they would likely be highly vulnerable to preemption if deployed anywhere near Chinese territory. Land-based tactical air forces are also unlikely to be effective owing to their limited range and basing vulnerabilities. Long-range bombers arriving from distant locations are too few in number to sustain a high-intensity air campaign against China in response to aggression.

Naval power is likely to be a more effective deterrent because its inherent mobility facilitates survivable positioning of forces, and because China's geographical circumstances dictate the use of maritime routes in pursuing most aggressive objectives. However, some naval systems are more compelling than others. Submarines are highly survivable, but lack the extensive striking power of other warships. Surface combatants have greater striking power, but their long-range munitions can still be quickly exhausted and generally cost over a million dollars for each target they destroy. Many of the surface combatants in the U.S. Navy are not even equipped for anti-ship operations.

Against that backdrop, large-deck, nuclear-powered aircraft carriers and their strike groups stand out as the most compelling combat system in the U.S. arsenal capable of deterring Chinese aggression. They have the same

mobility as other naval forces – in fact, carriers are so fast that they typically can outrun Chinese submarines. That mobility facilitates survival in wartime while also allowing optimum positioning for combat operations. From whatever location they operate, the carriers will be able to precisely attack hundreds of targets day after day for weeks at a time with little risk of depleting their munitions stocks.

Aircraft carriers thus present the greatest threat to Chinese military forces short of nuclear war if Beijing should choose to strike out beyond its traditional areas of operation close to home. Chinese leaders know that in the event of war, carriers would act in concert with other joint and national assets to quickly reduce the situational awareness and striking power of the People’s Liberation Army. That knowledge inevitably deters Chinese actions that might otherwise pose a major threat to neighboring nations.