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Sam J. Tangredi
The U.S. Naval War College

SIZING THE CARRIERS

A Brief History of Alternatives

Sam J. Tangredi

Ironically, it was an arms-control treaty that set the U.S. Navy on the course of building a fleet centered on fast, large-displacement, heavy-tonnage, full-flight-deck aircraft carriers. Such ships sometimes are referred to as *supercarriers*.

THE HISTORICAL PROGRESSION

The First Carriers

The Washington Naval Treaty of 1921–22—now at its hundredth anniversary—was an attempt by President Warren G. Harding and his Secretary of State, Charles Evans Hughes, to restrain a global naval arms race, particularly the naval competition among Great Britain, the United States, and Japan.[1] Idealism played a role, but there also was huge financial incentive; for the United States, with its army rapidly demobilized following World War I, naval expenditure was one of the largest federal government outlays.[2] And the most expensive platform was the battleship—the capital ship of its day. Much as nuclear warheads were during the later SALT/START era, battleships were the ultimate measure of military power.[3]

In contrast, the fledgling aircraft carrier constituted an auxiliary issue during treaty negotiations, and for the United States and Britain an aggregate limit of 135,000 tons eventually was set, rather than any specific number of platforms; imperial Japan would be permitted 81,000 tons, per the 5 : 5 : 3 formula that guided the conference.[4] However, there were some sublimits; no future carrier individually

Dr. Sam J. Tangredi is the Leidos Chair of Future Warfare Studies and professor of national, naval, and maritime strategy at the Naval War College. He served on active duty in the U.S. Navy, retiring as a captain. His most recent book (as coeditor) is AI at War: How Big Data, Artificial Intelligence, and Machine Learning Are Changing Naval Warfare *(Naval Institute Press, 2021). In 1981–82, then-Lieutenant Tangredi was boilers and propulsion fuels officer in USS* Ranger *(CV 61).*

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was to exceed 27,000 tons displacement (nor carry any gun larger than an eight-inch). By the time of the treaty, Britain—which had invented the all-aviation warship—had commissioned five aircraft carriers, with two others under construction. All except the first displaced between 26,000 and 29,000 tons—the obvious source of the treaty limit on individual ships. In contrast, the United States had not yet commissioned its first carrier, USS *Langley* (CV 1), which was a converted collier that would have a displacement of approximately 14,000 tons at full load. Japan was building its first aircraft carrier—the world's first purpose-built carrier constructed from the keel up, not a conversion—IJN *Hosho,* displacing slightly less than 10,000 tons.[5] In consideration of the Royal Navy's advantage, the treaty conference declared *Langley* and *Hosho* to be "experimental," thereby not counting against the tonnage limit.[6]

To American naval aviation, the 135,000-ton limit was actually a godsend. The U.S. Congress had expressed no interest previously in ever building an aircraft carrier fleet to that aggregate size, and in its long-range planning for the construction of future carriers the Navy leadership had expected much less from a fiscally conservative Congress.[7] Yet throughout the life of the treaty, the Department of the Navy was able to argue that the legislature needed to authorize building to that limit to maintain parity with the other treaty signatories—an argument that Congress eventually accepted.[8]

More importantly, there was another method of appealing to frugality. In addition to the United States disposing of older battleships and cruisers to achieve treaty limits in their respective categories, there were a number of under-construction warships, authorized during World War I but not completed, that would need to be scrapped. The American delegation to the Washington Conference proposed that each of the principal naval powers be allowed to convert two unfinished hulls into carriers, even if their displacements exceeded the 27,000-ton individual limit. Although this was of no advantage to a Royal Navy that was almost at its aggregate limit already, the proposal was accepted. As the U.S. Navy already had selected two unfinished battle cruisers, both of which likely would displace 33,000 tons, the conference agreed to 33,000 as the conversion limit. From this conversion came USS *Lexington* (CV 2) and USS *Saratoga* (CV 3).[9] Until construction of USS *Midway* (CV 41) in 1945, they were the biggest and fastest (thirty-one-plus knots) aircraft carriers the United States had built. Their large hulls and flight decks allowed them to accommodate the steadily increasing size of naval aircraft without the need for continual modification.[10]

Small Carriers and the Flying-Deck Cruiser

The true significance of the acquisition of *Lexington* and *Saratoga* is that—until the two ships proved their superiority in the fleet battle problems of the late

1920s—even the staunchest supporters of naval aviation within the Navy's leadership were convinced that a larger number of smaller carriers would be more operationally effective than a smaller number of supercarriers.[11]

Rear Admiral William A. Moffett, the first chief of the Department of the Navy's Bureau of Aeronautics—and often considered the father of naval aviation—was one of those so convinced.[12] While pleased with the commissioning of *Lexington* and *Saratoga*—whose allowance he himself essentially had arranged, as an influential expert assigned to the Washington Conference—Moffett frequently stated that "there is a far greater flight deck area available on a large number of small ships than a small number of large ships."[13]

Following the Washington Conference, Moffett drew up proposals for five carriers of 13,800 tons—the smallest tonnage that could provide a flight deck of acceptable length.[14] With 66,000 of the 135,000 tons permitted by treaty taken up by *Lexington* and *Saratoga,* the five small carriers would bring the Navy to the treaty limit while maximizing the number of flight decks.

However, Moffett considered the resulting seven total carriers to be insufficient, so he drafted an additional proposal for the construction of eight hybrid "flying deck cruisers."[15] Such a vessel would retain its forward emplaced guns but would have a flight deck covering most of the ship aft of the deckhouse. Moffett's argument was that, as cruisers, these ships would not count under the treaty limitations on carriers.[16] Estimated tonnage for each of these vessels was 10,000 tons—the limit for cruisers.[17]

The flying-deck cruiser actually gained the support of the Chief of Naval Operations (CNO), Admiral William V. Pratt, who—unlike Moffett—viewed it more as a cruiser than a small carrier.[18] However, the Navy General Board, whose recommendations to the Secretary of the Navy effectively took precedence over the individual views of the CNO (until Admiral Ernest J. King became CNO as well as Commander in Chief, U.S. Fleet, in March 1942), was cool to the idea, rejecting it first in 1925.[19] The follow-on to the Washington Conference, the London Naval Conference of 1930, retained the 135,000-ton limit on aircraft carriers.[20] This caused the General Board to reconsider, and Secretary of the Navy Charles F. Adams requested $20 million for an experimental flying-deck cruiser in the Navy's fiscal year (FY) 1932 budget request to Congress—unsuccessfully.[21] There were at least two congressional supporters, but by then expenditures for the Navy no longer were a priority.[22] With the onset of the Great Depression, neither the 13,800-ton small carriers nor the 10,000-ton flying-deck cruisers were built. Congress simply would not provide the money, and by the mid-1930s few in the naval leadership viewed either solution as a cost-effective method of massing airpower at sea.

Every Ship a Carrier?

Additionally, Moffett advocated that all ships, from battleship to destroyer, should embark aircraft: floatplanes (seaplanes), launched from trainable catapults. On their return, such planes would land on the ocean surface, then be winched back aboard. Tests proved that installation on destroyers was impractical; however, many battleships and cruisers were fitted with two scout aircraft. Moffett had argued for at least four—two scouts and two fighters. Proposed for the biggest ships was an addition of two bombers, for a total of six planes. In his estimate, these aircraft could conduct "small scale" offensive operations until the arrival of a carrier.[23]

Selected ships retained and operated catapult aircraft in World War II for scouting and for spotting for gunfire, particularly when carriers were not available (such as at the 1944 Normandy invasion). However, the physical limitations of such seaplanes made them incapable of dueling with wheeled carrier aircraft and most land-based planes. The pre–World War II Navy was never afraid to retain "legacy systems" that might prove useful, and it experimented with and operated seaplanes from combatants for twenty-four years. But the sea itself proved too treacherous a landing deck, regardless of its "low acquisition cost." Not only was it difficult to mass effects from small numbers of dispersed seaplanes—all of them inferior in combat capabilities to their land-based counterparts—but the environment itself proved the concept impracticable, and conducting small-scale offensive operations appeared suicidal.

However, technology did demonstrate eventually (about forty years after Moffett's proposal) that the concept of every ship being able to carry aircraft was, in fact, viable—once the helicopter was perfected. Starting in the 1970s, the U.S. Navy's Light Airborne Multipurpose System (LAMPS) embarked at least one aircraft (helicopter), and often two, on almost all cruisers, destroyers, and frigates, while a landing spot for a visiting helicopter was added to almost every other type of naval vessel.

These were very specialized aircraft, primarily designed for low, slow, antisubmarine warfare (ASW) operations, not for contesting with carrier-based conventional aircraft. LAMPS—like the problematic, preceding, drone antisubmarine helicopter (known as DASH) program and the subsequent embarked-drone aircraft of today—could be said to "conduct 'small scale' offensive operations until the arrival of a carrier."[24] But that is only to conduct several specialized missions, in which the aircraft in question remain highly vulnerable to attack by conventional aircraft.[25] The most advanced vertical/short-takeoff-and-landing (V/STOL) aircraft—even if they could be operated from ships smaller than big-deck amphibious warships—cannot match the range, lift capacity, or combat effectiveness of carrier aircraft (despite vociferous claims to the contrary by their

proponents).[26] In any case, the concept clearly has yet to be proved as a substitute for a large-deck, all-aviation ship.

***The Light Carrier Experience: USS* Ranger**

Moffett continued to consider the advantages of numerous smaller carriers, even as the speed and size of USS *Saratoga* enabled its famous simulated surprise attack on the Panama Canal in 1929.[27] Less heralded—perhaps because it seemed so disturbing in the light of subsequent events—was *Lexington* and *Saratoga*'s combined simulated surprise attack on Pearl Harbor in 1932.[28] Rear Admiral Joseph M. Reeves, Commander, Aircraft Squadrons, Battle Fleet, gradually had increased the aircraft complement of *Saratoga,* as well as on the small, slow *Langley;* while *Saratoga* was rated at seventy-four aircraft, Reeves increased its air wing to ninety, and *Langley*'s aircraft load was doubled from twenty-four to forty-eight.[29]

Theoretically, two small carriers could provide the same number of aircraft in the air if they could be operated together against one lone large carrier. But what bedeviled Moffett—as it has every other small-carrier proponent up to today—is that he could not build a suitably capable smaller carrier for half the price of a larger ship that would have more than double the combat effectiveness. In building USS *Ranger* (CV 4) at 18,000 tons full displacement, he was able to keep the financial cost (in contemporaneous dollars) to approximately half the final construction cost of either *Lexington* or *Saratoga,* but it was at the opportunity cost of speed, survivability (no underwater protection, and consistently overweight in terms of sea keeping), and aircraft and weapons load. (In addition, the final costs of *Lexington* and *Saratoga,* which included a 90 percent overrun, were magnified by the nature of their conversion, so they were not considered representative.) *Ranger,* commissioned in 1934, initially could not carry torpedo bombers—which took on a greater significance during World War II than it bore at the ship's commissioning.[30]

More importantly, *Ranger*'s small size meant that it could not keep up with the continuing increases in size and maintenance requirements of newer aircraft, unlike *Lexington* and *Saratoga* and subsequent large carriers. This increase was required particularly to match the fighting capabilities of Japanese aircraft. So as aircraft on both sides became more capable, *Ranger* slipped toward obsolescence.[31] The result was that the naval leadership deemed World War II Pacific operations too dangerous for *Ranger,* so it was kept in the Atlantic, where operations against U-boats were considered to be of slower pace and where the ship would not face attack by massed enemy aircraft. *Ranger* did participate in support of Operation TORCH and the North Africa landings.[32] However, its overall contributions were not considered significant, because land-based aircraft were readily available in the European theater.[33]

Rear Admiral Moffett did not live to see the commissioning of *Ranger;* he died in the crash of the airship USS *Akron* (ZRS 4) in 1933. However, a series of

"carrier spectrum studies" conducted prior to and during the development of *Ranger* estimated that four thousand additional tons of aircraft carrier displacement resulted in the ability to add fifteen more aircraft—which was why *Ranger* was built with an 18,000-ton displacement rather than the 13,800 that would have provided five carriers under the treaty.[34] But an additional four thousand on top of that might have added even more. Thus, the overall conclusion was that large carriers could be built at less of a relative incremental cost than was possible by restricting them to a smaller size. Reportedly, Moffett later in his career expressed regret at the decision to build *Ranger*. Moffett's biographer William Trimble summarized the admiral's conclusions, as contained in a 1931 letter to the Secretary of the Navy, as follows: "greater displacement, he argued, allowed higher speed, more compartmentalization, armor protection for machinery and magazine spaces, and more hangar and flight deck space."[35] The experiment did not work.[36]

The follow-on *Yorktown* (CV 5) and *Enterprise* (CV 6) were each of 25,000 tons full displacement. Another small carrier, USS *Wasp* (CV 7), similar to *Ranger,* was built at 18,000 tons displacement; however, it had been approved in 1934, before *Ranger* proved itself inadequate.[37] Subsequent fleet carriers were built at 34,000 tons full displacement.

The Light and Escort Carriers of World War II

The U.S. Navy did build light and escort carriers to complement fleet carriers during World War II. Most were vessels specialized for the escort of convoys, air support for amphibious operations, and ASW. Flattops of their type were considered "mobilization carriers." Many were converted civilian ships. The inexorable requirement to build warships as quickly as possible precluded taking the time necessary to construct an all-large-carrier force. To some extent, these ships were considered expendable—and some were expended. Again, the Navy needed mass and numbers, given the attrition inevitable in warfare.

The twenty-fifth through the thirtieth USN aircraft carriers were considered "light carriers" or "austere carriers" and were designated CVL. Each was built in two years or less, most were commissioned in 1943, and they sacrificed size and survivability for speed of construction.[38] Using materials already in the production pipeline, some were built on cruiser hulls.[39] Their displacements ranged from 16,000 to 19,000 tons. The Navy intended to operate them alongside the large fleet carriers (within large, carrier-centered battle groups)—as wingmen, if you will—not independently.[40] The ratio of propulsion plant to displacement was proportionally large, to generate the thirty-knot speed necessary to keep up with the larger fleet carriers. The CVLs' goal was to provide as much *additional* air cover to the task force as possible. Operating within (and protected by) the task force, all these ships survived the war; however, "they did not lend themselves to the changing requirements of carrier aviation post war."[41]

Escort carriers (CVEs) were built only to support the escorting of convoys (ASW), amphibious operations, and such duties as transporting aircraft (including land-based aircraft) to replace losses in the island campaigns.[42] Some were of new construction, some were conversions; a total of 120 were built during the war.[43] Many were built for the Royal Navy. Again, speed of construction was everything; some were readied in ten months, from launch to commissioning. Their displacements ranged from 10,000 to 14,000 tons. Flight decks were one-third the size of those of fleet carriers.

With an average maximum speed of twenty knots, the CVEs could not operate with a battle group. During amphibious operations they were expected to remain under the air cover provided by the large fleet carriers or land-based U.S. Marine aviation, if the Marines were established ashore.[44] Protection against surface warships and submarines was provided by cruisers and destroyers. If the CVEs encountered Japanese ships when they were without protective carrier air cover (such as in the October 1944 battle of Samar), they were expected to withdraw. At Samar, a force of escort carriers and destroyers fought off a Japanese force, but at a loss of two CVEs by surface fire (plus two destroyers and a destroyer escort) and over one thousand sailors—more than at the Battles of the Coral Sea and Midway combined.[45]

CVLs and CVEs were built to provide *additional* mass and numbers, to overwhelm Japanese forces. To put that in perspective, the Japanese entered World War II with eight carriers and built twenty-one total CV, CVL, and CVE equivalents during the war, whereas the United States entered World War II with eight fleet carriers (split between two oceans), then built *146* carriers of all sizes during the war (that number is dependent on the counting rules). To repeat: 21 versus 146.

CVLs and CVEs never were expected to substitute for fleet carriers. Rather, they depended on fleet carriers for their survival.[46]

Postwar Carriers

USS *Midway* (CV 41) was the first aircraft carrier completed after the war, although its construction was started during the war. With an original displacement of approximately 45,000 tons, the ship dwarfed all previous carriers. It was the lead ship of an eight-carrier class.

Midway served for forty-seven years. Its large size allowed it and two counterparts, *Franklin D. Roosevelt* (CV 42) and *Coral Sea* (CV 43), to be converted to handle jet aircraft via the addition of an angled flight deck (among other modifications). A handful of the previous, smaller, World War II *Essex*-class carriers also were converted to handle jets, allowing them to take their turn on Yankee Station during the Vietnam War. The unconverted ships of the *Midway* class went on to other duties; for example, USS *Valley Forge* (CV 45) and the even older

Essex-class USS *Boxer* (CV 21) could be considered the first amphibious assault ships, comparable in concept to today's USS *America* (LHA 6), which, like *Valley Forge,* does not have a well deck and displaces 45,000 tons.[47]

The bureaucratically bloody Department of Defense fight in 1949 over the proposed supercarrier *United States* (80,000 tons) resulted in cancelation of the program and a seeming repudiation of the value of the big-deck carrier—largely under the assumption that the next war would consist of nuclear strikes conducted by U.S. Air Force bombers. For many of the Navy participants, it took on the appearance of a fight for the service's very existence (along with that of the U.S. Marine Corps).[48]

However, subsequent to the cancelation, real-world requirements dramatically changed perceptions and assumptions. The swift advance of the North Korean army into the South captured almost all land air bases available to the South Korean and U.S. air forces, so the initial means of applying airpower was the remaining World War II–era aircraft carriers. Thus, when the six-ship USS *Forrestal* class was built (1952–61), there was much less opposition.[49] Again, the perception was that the fast, large-displacement, heavy-tonnage, full-flight-deck aircraft carrier had been determined to be both necessary and combat proven.

Lingering Proposals and Alternatives

This did not mean that alternative proposals disappeared.[50] The continuing development of the helicopter and the prospective development of V/STOL technology inspired a continuing search for (presumably) lower-cost alternatives.

Helicopters certainly could not provide the capabilities of fixed-wing aircraft, but they could land Marines ashore, thereby bypassing the difficulties of surface amphibious landings. Therefore, supposedly lower-cost, specialized, "big deck" amphibious assault ships—which could remove this mission from the lengthy mission sets of conventional carriers—were justified.[51]

Great hopes were placed that V/STOL aircraft development would allow for smaller carriers that did not require long flight decks, catapults, and arresting gear. From 1972 to 1978, and particularly during the administration of President Jimmy Carter, the Office of the Secretary of Defense and the Navy examined a bevy of small-carrier proposals.[52]

Frequently noted is CNO Admiral Elmo R. Zumwalt Jr.'s proposal for a V/STOL-carrying "sea control ship."[53] However, Zumwalt himself directed the proposal to the specific mission of ASW, not as an alternative to the large air wings and immense strike capabilities of large carriers.[54] From Zumwalt's perspective, the search for alternatives constituted a quest to reduce the unit cost of ships to "recover from the disastrous slide" in the total number of ships in the overall fleet as the result of the retirement of the remaining (albeit modernized) World War II inventory.[55]

The constant refrain of these proposals was the need to reduce the per-unit acquisition costs of ships, and the view that the increasing costs of large-carrier construction—resulting primarily from the inclusion of emerging technologies, along with the increasing cost of labor and materials, plus inflation—made the ships "unaffordable."[56] However, this bumped up against the conundrum that V/STOL aircraft simply could not match conventional, fixed-wing aircraft in any mission area.[57] The physical reality is that the power and thrust required to lift aircraft vertically result in a necessary reduction in carrying load and fuel, as well as a potential reduction in speed as a result of configuration.[58] V/STOL aircraft could not compete effectively (or even survive) in an airspace dominated by capable, conventional military aircraft; rather, they could operate effectively only in conditions of limited opposing air threats.[59] The development of the "ski jump" that allowed V/STOL aircraft to be launched via a "rolling start" could increase carrying load and range, since less power and fuel would be required at takeoff—but not so significant an improvement that they could approach the capabilities of conventional carrier aircraft.[60] Meanwhile, development of the *Nimitz*-class, nuclear-powered, large-deck carrier (90,000 tons full-load displacement) had begun.

The debates on alternatives came to a climax when President Carter vetoed the FY-79 defense bill since it included long-term funding for a fourth *Nimitz*-class carrier. However, the ship eventually was reinstated owing to the requirement for unprecedented operations in the Indian Ocean to counter the global expansion of the Soviet Navy, as well as trouble in the Middle East in the wake of the fundamentalist revolution in Iran. To respond to these challenges, nuclear-powered, large-deck carriers appeared necessary.[61]

One rather slender argument made in favor of the U.S. Navy's examination of other carrier configurations was that the Soviet Navy had adopted them successfully. If the Soviet Navy thought it could challenge the U.S. Navy on the high seas, it was postulated, there must be something to these configurations—particularly if they could be built more cheaply than a large, nuclear-powered CV.[62]

Of particular interest were the *Kiev*-class "heavy aviation cruisers" or "heavy aircraft-carrying cruisers." *Kiev* and its sisters appeared to be more-formidable warships than any individual platform in the U.S. inventory. Their foredecks bristled with awesome displays of cruise and surface-to-air missiles. These included the SS-N-12 Sandbox (nuclear capable), the SA-N-3 Shtorm, the SA-N-4 Gecko, the SUW-N-1 ASW rocket (nuclear capable), and the RBU-6000 depth charge system. Additionally, they carried 76 mm guns, torpedo tubes, and an assortment of close-in weapons. Their afterdecks were taken up with an angled flight deck that could accommodate a mix of thirty-two V/STOL aircraft and helicopters.[63] Essentially, they were Moffett's flying-deck cruisers.

However, by the later stages of the Cold War it became apparent that although the *Kiev* class was capable of performing modest strike-at-sea missions, it was not designed to provide the capabilities of an aircraft carrier. It had a specialized mission: defending the Soviet nuclear strategic-ballistic-missile bastions in waters close to the Soviet Union.[64] This was a mission that the U.S. Navy obviously did not have. The missions that the U.S. Navy did have required capabilities beyond those offered by combat-limited V/STOL aircraft. The flying-deck cruisers—as devastating as they seemed visually—simply did not fit U.S. operational requirements.

THREE POINTS FOR DISCUSSION

What can one conclude from this history? Three points identify themselves.

The first is that—operationally—the U.S. Navy has sound reasons for preferring a large-deck aircraft carrier over any smaller variant.[65] History is our truest laboratory, and fast, large-displacement, heavy-tonnage, full-flight-deck aircraft carriers have proved superior in war. With nuclear power plants, they are globally deployable. They are not some sort of naval fetish.

Second, the argument that small carriers can substitute for them—even in a world of modern technology—is unproven.[66] They certainly could not during World War II, nor in subsequent naval operations. V/STOL aircraft remain a less-capable substitute for conventional carrier aircraft.[67] One can speculate regarding the damage a People's Liberation Army DF-21 missile might effect if it struck a large carrier—but first it would have to hit it, which would be far from certain in a war characterized by deception and a struggle for use of the electromagnetic environment.[68] A small carrier, if struck, is less likely to survive. Again, this was demonstrated in World War II.

The third point is that, in the end, the debate over aircraft carriers always boils down to cost. Their acquisition costs are much higher than for other ships and other single-item defense programs, making them a natural target for criticism. Yet that always has been true. The conversion costs of *Lexington* and *Saratoga* were estimated initially at $21 million each, but their final costs were $40 million apiece—a nearly 90 percent cost overrun. And yes, there were a lot of screaming critics at the time—including congressmen. Combined with a simplistic perception of vulnerability, high costs tend to cause critics to declare aircraft carriers "unaffordable" and "vulnerable."[69] However, it is very fair to ask—as former Secretary of the Navy John F. Lehman and Steven Wills phrase the question—"Compared to what?"[70]

As Norman Friedman writes, "The belief that somehow the aviation community and the carrier designers are conspiring to hide the real advantages of smaller and less expensive carriers persists to this day."[71] However, small does

not inevitably prove to be less expensive. An interesting acquisition case study would be to investigate whether the total spent (for ships, modules, and required developmental programs) of the Littoral Combat Ship program—in which ships already are starting to be decommissioned—would have bought one carrier or two (particularly if, as Lehman and Wills propose, they were the size of a nonnuclear USS *Midway*).[72]

Likewise, instead of proposing only to reduce the carrier force to fund other defense programs, it is logical and analytically sound to ask which programs could be reduced or eliminated to fund carriers—especially if we are firm in our desire to avoid another Afghanistan-type commitment and to adjust our defense resources accordingly. After all, aircraft carriers are combat-proven systems, while their vulnerability to modern military technology remains unproven.[73]

To suggest a more thorough study of alternatives that includes a fair hearing for high capabilities as well as lesser ones does not necessarily represent unqualified support for large aircraft carriers.[74] On the other hand, neither does it mean they should be rejected summarily.

A POSTSCRIPT: DID THE PLAN CONSIDER THE FLYING-DECK CRUISER—AND REJECT IT?

The first People's Liberation Army Navy (PLAN) aircraft carrier, the ex–Soviet Navy *Varyag* (now *Liaoning*), ostensibly was purchased by a "private" People's Republic of China (PRC) company for conversion into a floating casino; it never became a casino. That is a story well known.[75] A second carrier was built to the same specifications. The third (and larger) carrier now under construction is an attempt to incorporate new technologies developed for the latest U.S. carrier, such as the electromagnetic aircraft launch system (i.e., EMALS).[76]

Less known is the fact that PRC companies also purchased two of the four ex-Soviet *Kiev*-class heavy-aviation cruisers, ostensibly as theme-park attractions. Neither was particularly successful in that intended role. The first (ex-*Kiev*) later was converted into a "luxury" hotel (reported to be near insolvency, having failed to attract sufficient guests).[77] The second (ex-*Minsk*), with its parent theme park failing, was acquired by the PRC government in 2016 for display in a naval museum in Jiangsu.[78]

It is not unreasonable to ponder whether these flying-deck cruisers were purchased as speculative private ventures with the hope that they (like *Varyag*) would be purchased, in turn, by the PLAN. The incongruous nature of their "private" acquisition—which included the cost of towing two poorly maintained large hulks to China to be massively refurbished for use in a relatively low-revenue industry—primes this speculation. Although there is no available documentation, it is very logical that they were examined (to some extent) as potential additions to

the PLAN fleet but were rejected. Perhaps the repair, upgrading, and conversion costs were seen as too great. The mission for which they were built—defense of the Soviet nuclear-ballistic-missile submarine bastions—is not a PLAN mission (as far as we know).

Or perhaps, like the United States in the 1930s, the PRC has determined that larger, all-aviation ships are a superior (in fact, the most desirable) method for bringing airpower to sea.

NOTES

1. For a "realist's" reflection on the motives behind the Washington Naval Conference on its hundredth anniversary, see Kori Schake, *Safe Passage: The Transition from British to American Hegemony* (Cambridge, MA: Harvard Univ. Press, 2017), pp. 235–53. For an assessment of the conference and resulting treaty as an arms-control process, see Emily O. Goldman, *Sunken Treaties: Naval Arms Control between the Wars* (University Park: Pennsylvania State Univ. Press, 1994).
2. Thomas H. Buckley, "The Icarus Factor: The American Pursuit of Myth in Naval Arms Control, 1921–36," in *The Washington Conference, 1921–22: Naval Rivalry, East Asian Stability and the Road to Pearl Harbor,* ed. Erik Goldstein and John Maurer (London: Frank Cass, 1994), pp. 126–27.
3. SALT refers to Strategic Arms Limitation Talks (1969–79); START refers to Strategic Arms Reduction Talks (1982–91), with variations in the form of START II (1992–2000) and New START (2011). In between was SORT (Strategic Offensive Reductions Treaty, 2002). Sources that emphatically associate the Washington Naval Conference with Cold War efforts at arms control are Coit D. Blacker and Gloria Duffy, *International Arms Control: Issues and Agreements* (Stanford, CA: Stanford Univ. Press, 1984), pp. 81–93; Barry M. Blechman et al., eds., *Naval Arms Control: A Strategic Assessment* (New York: St. Martin's, 1991); and Robert Gordon Kaufman, *Arms Control during the Pre-nuclear Era: The United States and Naval Limitation between the Two World Wars* (New York: Columbia Univ. Press, 1990). A more skeptical view of the association is Sam J. Tangredi, "Naval Strategy and Arms Control," *Washington Quarterly* 14, no. 3 (Summer 1991), pp. 201–209.
4. There are numerous sources that explain the ratio and details of the treaty, of which Goldman's *Sunken Treaties* is but one. The definitive source for official U.S. documents concerning the conference and treaty is Joseph V. Fuller, ed., *1921,* Foreign Relations of the United States (Washington, DC: U.S. Government Printing Office, 1936), vol. 1, docs. 28–101, available at history.state.gov/.
5. Britain had laid the keel for its first purpose-built carrier, HMS *Hermes,* before imperial Japan started construction; however, *Hosho* was launched first. See Kathrin Milanovich, "*Hôshô:* The First Aircraft Carrier of the Imperial Japanese Navy," in *Warship 2008,* ed. John Jordan (London: Conway, 2008), pp. 9–25. Chesneau takes issue with *Hosho* being proclaimed the first purpose-built carrier in Roger Chesneau, *Aircraft Carriers of the World, 1914 to the Present* (Annapolis, MD: Naval Institute Press, 1984), p. 157.
6. Norman Friedman, *U.S. Aircraft Carriers: An Illustrated Design History* (Annapolis, MD: Naval Institute Press, 1983), p. 37. However, the United States included *Langley* in the total aircraft carrier tonnage allocation following passage of the 1934 Vinson-Trammell Act. In 1936, *Langley* was converted into a seaplane tender. Since *Hosho* was under 10,000 tons, it was not regulated as an aircraft carrier.
7. William F. Trimble, *Admiral William A. Moffett: Architect of Naval Aviation* (Washington, DC: Smithsonian Institution, 1994), p. 97; Charles M. Melhorn, *Two-Block Fox: The Rise of the Aircraft Carrier, 1911–1929* (Annapolis, MD: Naval Institute Press, 1974), p. 98;

Goldman, *Sunken Treaties,* p. 174. Goldman notes that prior to the Washington Treaty "every naval building program since 1918 submitted by the General Board to Congress had included one or more carriers, and none had been authorized."

8. Melhorn, *Two-Block Fox,* p. 98. A detailed analysis of the Washington Treaty's actual effect on the size and capabilities of the U.S. Navy is Thomas C. Hone, "The Effectiveness of the 'Washington Treaty' Navy," *Naval War College Review* 32, no. 6 (November–December 1979), pp. 35–59, available at www.jstor.org/.
9. Both ships eventually came to 36,000 tons displacement. However, there was a clause in the treaty that allowed for 3,000 tons to be added to capital ships (battleships) for additional protection against submarines (reflecting on German submarine operations in World War I). The United States successfully argued (or at least justified to itself) that this addition also applied to aircraft carriers. Friedman, *U.S. Aircraft Carriers,* p. 43. Goldman considers this to have constituted a violation of the treaty. Goldman, *Sunken Treaties,* p. 173.
10. Friedman, *U.S. Aircraft Carriers,* pp. 48–49. Badly damaged in the Battle of the Coral Sea in 1942, *Lexington* required five torpedo hits to scuttle. As a target ship in 1946, *Saratoga* was sunk in a second atomic bomb test, having survived the first.
11. Admittedly, it is anachronistic to use the term *supercarrier* for that era, it first being used in the late 1940s. However, it is apt for comparing *Lexington* and *Saratoga* with the preceding *Langley* and the follow-on *Ranger* (CV 4). The "super carrier" term came in vogue with the debate over the proposed USS *United States* in 1949. It subsequently has been applied to the *Forrestal*-class and follow-on carriers. An example is Andrew Faltum, *The Supercarriers: The* Forrestal *and* Kitty Hawk *Classes* (Annapolis, MD: Naval Institute Press, 2014).
12. On Moffett changing his mind several times on this issue, see Melhorn, *Two-Block Fox,* pp. 108–10.
13. Trimble, *Admiral William A. Moffett,* p. 212. A discussion of Moffett's view on flight decks is in Edward Arpee, *From Frigates to Flat-Tops: The Story of the Life and Achievements of Rear Admiral William Adger Moffett, U.S.N., the "Father of Naval Aviation"; October 31, 1869–April 4, 1933* (Chicago: Lakeside, 1953), pp. 150–51.
14. Melhorn, *Two-Block Fox,* p. 111. Melhorn uses the term "tactically sound" to describe the 13,800-ton CVs.
15. Thomas Wildenberg, *All the Factors of Victory: Adm. Joseph Mason Reeves and the Origins of Carrier Airpower* (Annapolis, MD: Naval Institute Press, 2003), pp. 212–13; Trimble, *Admiral William A. Moffett,* pp. 210–11.
16. Trimble, *Admiral William A. Moffett,* p. 217.
17. In her study of the Washington Naval Treaty, Goldman suggests that there was another "loophole" the Navy could have used to increase the number of flight decks. She points out that the treaty defined an aircraft carrier as "a vessel of war in excess of 10,000 tons standard displacement, designed for the specific and exclusive purpose of carrying aircraft." Ipso facto, any ship less than 10,000 tons, even if it was all flight deck, still would not be an "aircraft carrier" and would be restricted by neither the carrier limits nor the cruiser limits. Whether this ever occurred to the USN leadership (it appears it did not), Goldman concedes that "at the time it was not deemed feasible to construct a carrier of 10,000 tons or less." Goldman, *Sunken Treaties,* p. 175.
18. Trimble, *Admiral William A. Moffett,* p. 254.
19. Ibid., pp. 210, 224. For a more detailed (and nuanced) understanding of the Navy General Board, see John T. Kuehn, *Agents of Innovation: The General Board and the Design of the Fleet That Defeated the Japanese Navy* (Annapolis, MD: Naval Institute Press, 2008), and John T. Kuehn, *America's First General Staff: The Rise and Fall of the General Board of the U.S. Navy, 1900–1950* (Annapolis, MD: Naval Institute Press, 2017).
20. Between the Washington and London Conferences, the Geneva Naval Conference of 1927 ended without agreement.
21. Trimble, *Admiral William A. Moffett,* pp. 210, 225.
22. They were Reps. James V. McClintic (D-OK) and Carl Vinson (D-GA). Ibid., pp. 210, 225–26.

Vinson served for many years as chairman of the House Naval Affairs Committee and, later, the House Armed Services Committee. He was the namesake of USS *Carl Vinson* (CVN 70).

23. Ibid., pp. 98–99.
24. A contemporary history of the LAMPS program can be drawn from R. E. Hammond [Lt. Cdr., USN] and Pat Tierney [Lt., USN], "The LAMPShip Team," U.S. Naval Institute *Proceedings* 104/3/901 (March 1978), available at www.usni.org/; Dan Manningham, "LAMPS III," U.S. Naval Institute *Proceedings* 104/3/901 (March 1978), available at www.usni.org/; George Galdorisi [Capt., USN], "Tuning on LAMPS III," U.S. Naval Institute *Proceedings* 112/10/1,004 (October 1986), available at www.usni.org/; George Galdorisi [Capt., USN] and Jim Stavridis [Cdr., USN], "Ship-Helo Team Key to New Strategy," U.S. Naval Institute *Proceedings* 120/1/1,091 (January 1994), available at www.usni.org/; and George Galdorisi [Capt., USN (Ret.)] and Scott C. Truver, "Helicopter Procurement: Playing with Fire," U.S. Naval Institute *Proceedings* 133/9/1,255 (September 2007), available at www.usni.org/. On DASH, see Thomas Pinney [Capt., USN (Ret.)], "UAVs: Before Fire Scout There Was DASH," U.S. Naval Institute *Proceedings* 144/8/1,386 (August 2018), available at www.usni.org/.
25. A discussion of small carriers designed for helicopters for use in ASW and sea control is R. H. Klipjgert [Lt. Cdr., USN], "Sea Control Aircraft: The Case for the Chopper," U.S. Naval Institute *Proceedings* 101/4/866 (April 1975), available at www.usni.org/.
26. Many of these proponents have been naval officers (and officers from other services) who have debated in the pages of the U.S. Naval Institute *Proceedings* over the years. See, for example, John B. Kusewitt Jr. [Lt. Col., USA], "The Future of Navy VTOL Systems," U.S. Naval Institute *Proceedings* 99/9/847 (September 1973), pp. 25–35.
27. Wildenberg, *All the Factors of Victory,* pp. 1–10; James H. Belote and William M. Belote, *Titans of the Seas* (New York: Harper and Row, 1975), pp. 18–19.
28. Clark G. Reynolds, *The Fast Carriers: The Forging of an Air Navy* (Huntington, NY: Krieger, 1978), p. 18.
29. Wildenberg, *All the Factors of Victory,* pp. 155–56.
30. Friedman, *U.S. Aircraft Carriers,* pp. 75–77.
31. A short but harsh reflection on *Ranger* from one of its former aviators is James S. Russell [Adm., USN (Ret.)], "The *Ranger:* Atavistic Anomaly," in "A Salute: The Diamond Jubilee of Naval Aviation," supplement, U.S. Naval Institute *Proceedings* 112/4/998 (April 1986), pp. 52–53.
32. Belote and Belote, *Titans of the Seas,* pp. 133–34. For details on *Ranger* in TORCH, see Vincent P. O'Hara, *TORCH: North Africa and the Allied Path to Victory* (Annapolis, MD: Naval Institute Press, 2015), pp. 193–94.
33. Friedman, *U.S. Aircraft Carriers,* p. 76.
34. Ibid., p. 59.
35. Trimble, *Admiral William A. Moffett,* p. 226. Trimble also states (p. 15) that "he [Moffett] had to admit that the small carrier was more attractive in theory than in practice."
36. Even Goldman states bluntly, "The *Ranger* proved wholly ineffective during World War II." Goldman, *Sunken Treaties,* p. 161.
37. Once again, the pre–World War II Navy was always reluctant to divest itself of legacy systems. It viewed mass and numbers as critical in light of the inevitable attrition of war fighting. In World War II, *Wasp* operated briefly in the Mediterranean, then was shifted to the Pacific, where it was sunk in 1942. Designed with limited underwater protection—to save size, weight, and cost—it could not survive torpedo attack. Belote and Belote, *Titans of the Seas,* pp. 156–57.
38. For a comparison of USS *Independence* (CVL 22) with its larger *Essex*-class companions, see ibid., pp. 202–203.
39. These hulls were much smaller than those of battle cruisers, which were much closer to battleships in size. Friedman, *U.S. Aircraft Carriers,* p. 160. A concise comparison between the CV and CVL is at Belote and Belote, *Titans of the Seas,* pp. 202–204.
40. Belote and Belote, *Titans of the Seas,* pp. 215–16.
41. Chesneau, *Aircraft Carriers of the World,* p. 233.
42. The definitive work on CVEs remains William T. Y'Blood, *The Little Giants: U.S. Escort*

Carriers against Japan (Annapolis, MD: Naval Institute Press, 2012).

43. This figure depends on how one counts the preceding "mobilization carriers" (AVGs) and those completed but not commissioned or only partly completed.

44. Additionally, Navy squadrons and orphaned aircraft that could not return to their carriers also flew from Marine airfields. Barrett Tillman, *On Wave and Wing: The 100-Year Quest to Perfect the Aircraft Carrier* (Washington, DC: Regnery History, 2017), pp. 116–17.

45. Samuel Eliot Morison, *History of United States Naval Operations in World War II,* vol. 12, *Leyte: June 1944–January 1945* (Boston: Little, Brown, 1958), p. 316.

46. An article that lauds the CVLs as representing innovative thinking that should be emulated today is Andrew Rucker [Lt. Cdr., USN], "The Little Carriers That Could," U.S. Naval Institute *Proceedings* 147/6/1,420 (June 2021), pp. 53–57.

47. Friedman, *U.S. Aircraft Carriers,* pp. 365–69. USS *Princeton* (CV 23) also was converted, as were several CVEs. USS *America* (LHA 6) sometimes is referred to as "the lightning carrier" because it carries the F-35B (V/STOL variant) Lightning II. It is not considered a "light carrier" by the U.S. Navy.

48. One of the best discussions is in Jeffrey G. Barlow, *Revolt of the Admirals: The Fight for Naval Aviation, 1945–1950* (Washington, DC: Naval Historical Center, 2001).

49. Friedman, *U.S. Aircraft Carriers,* pp. 256–57.

50. See, for example, Pete Pagano [Capt., USN (Ret.)], "The CVL's Time Has Come," U.S. Naval Institute *Proceedings* 147/9/1,423 (September 2021), pp. 12–13.

51. An argument in favor of using amphibious assault ships as light carriers is Jonathan D. Caverley and Sam J. Tangredi [Capt., USN (Ret.)], "Amphibs in Sea Control and Power Projection," U.S. Naval Institute *Proceedings* 144/4/1,382 (April 2018), pp. 18–22, available at www.usni.org/.

52. Norman Friedman reports: "The Naval Ship Engineering Center . . . developed about fifty alternative VSTOL support ships (VSS) [plans] between November 1974 and December 1975." Friedman, *U.S. Aircraft Carriers,* p. 354.

53. A concise discussion of the logic behind the sea-control ship is John L. Canaday [Lt. Cdr., USN], "The Small Aircraft Carrier: A Re-evaluation of the Sea Control Ship" (master's thesis, U.S. Army Command and General Staff College, 1990), pp. 11–23.

54. Elmo R. Zumwalt Jr., *On Watch: A Memoir* (New York: Quadrangle / New York Times Book, 1976), pp. 75–77; Friedman, *U.S. Aircraft Carriers,* p. 354.

55. Friedman, *U.S. Aircraft Carriers,* p. 324.

56. Critics have not been exclusively civilians; many have been naval officers who also have debated in the pages of the U.S. Naval Institute *Proceedings* over the years. See, for example, Stephen T. DeLaMater [Capt., USN (Ret.)], "The Carrier," U.S. Naval Institute *Proceedings* 102/10/884 (October 1976), pp. 66–74.

57. Friedman, *U.S. Aircraft Carriers,* p. 323. Friedman explains: "If a VSTOL carrier attacked shore targets, it would be able to project only a small fraction of the weight of ordnance a conventional air group could move. To achieve a like level of destruction, several small carriers, costing perhaps several times as much as a single large-deck unit, might be required."

58. This has been recognized throughout the debate on V/STOL carriers. See, for example, James L. George [Lt., USN (Ret.)], "The V/STOL Catch 22s," U.S. Naval Institute *Proceedings* 104/4/902 (April 1978), pp. 22–29.

59. Defense Science Board, *Future of the Aircraft Carrier* (Washington, DC: Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics, October 2002), p. 46. The report gently states that an all-V/STOL carrier would "require legacy aircraft support (E-2C, EA-6B, E-JSF), new sea-based support aircraft, or joint assets."

60. Eric Grove, *The Future of Sea Power* (Annapolis, MD: Naval Institute Press, 1990), pp. 142–44.

61. Friedman, *U.S. Aircraft Carriers,* p. 324.

62. Michael A. Cairl, "Through-Deck Cruiser: The New Capital Ship," U.S. Naval Institute *Proceedings* 104/12/910 (December 1978), pp. 34–42.

63. Chesneau, *Aircraft Carriers of the World,* pp. 192–95.

64. The prominence of this Soviet mission only became clear in the 1980s. See Christopher Ford and David Rosenberg, *The Admirals' Advantage: U.S. Navy Operational Intelligence in World War II and the Cold War* (Annapolis, MD: Naval Institute Press, 2005), pp. 82–87.

65. Even when examining options, future missions, and doctrine for aircraft carriers, the argument remains that "nonnuclear ships under about eighty thousand tons sacrifice too much total combat capability to be worthwhile investments as aircraft carriers." Robert C. Rubel, "The Future of Aircraft Carriers," *Naval War College Review* 64, no. 4 (Autumn 2011), p. 25, available at digital-commons .usnwc.edu/.

66. Bradley Martin and Michael McMahon, *Future Aircraft Carrier Options* (Santa Monica, CA: RAND, 2017), p. 48, available at www .rand.org/.

67. Pagano, "The CVL's Time Has Come," p. 13.

68. The costs of DF-21s and CVs have been compared frequently. An example is Henry J. Hendrix, *At What Cost a Carrier?* (Washington, DC: Center for a New American Security, March 2013), available at www.cnas.org/.

69. Such critiques circulate through the media and build mass through repetition. The "unaffordable" and "vulnerable" assessments have been repeated widely in media ranging from popular science magazines to investment websites, most citing the same sources. See, for example, Kyle Mizokami, "Are We Nearing the End of the Supercarrier?," *Popular Mechanics,* 12 March 2020, www.popular mechanics.com/, and Gillian Rich, "This Icon of U.S. Power Is More Sinkable Than Ever but Hard to Kill Off," *Investor's Business Daily,* 31 January 2020, www.investors.com/.

70. John F. Lehman, with Steven Wills, *Where Are the Carriers? U.S. National Strategy and the Choices Ahead* (Philadelphia: Foreign Policy Research Institute, 2021), p. 49.

71. Friedman, *U.S. Aircraft Carriers,* p. 323.

72. For a devastating critique of the Littoral Combat Ship midway in the program, see John Patch [Cdr., USN (Ret.)], "The Wrong Ship at the Wrong Time," U.S. Naval Institute *Proceedings* 137/1/1,295 (January 2011), available at www.usni.org/. Any study of the LCS should begin with Ronald O'Rourke's series of Congressional Research Service reports, with their extensive citations. The latest version is available at crsreports.congress.gov/.

73. This point is made in Lehman, *Where Are the Carriers?,* pp. 49–64.

74. Again, these debates have happened within the Navy. See Reuven Leopold, "Designing the Next Aircraft Carriers," U.S. Naval Institute *Proceedings* 103/12/898 (December 1977), pp. 33–39. As the technical director for ship design at the Naval Ship Engineering Center, Leopold was the top naval ship designer of the 1970s.

75. A detailed source is Minnie Chan, "The Inside Story of the *Liaoning:* How Xu Zengping Sealed Deal for China's First Aircraft Carrier," *South China Morning Post,* 19 January 2015, www.scmp.com/.

76. Matthew Funaiole, Joseph S. Bermudez, and Brian Hart, "China's Third Aircraft Carrier Takes Shape," *Center for Strategic and International Studies Commentary,* 15 June 2021, www.csis.org/.

77. If one would like to book a reservation, the website is www.uniqhotels.com/binhai -aircraft-hotel/.

78. "Former Soviet Aircraft Carrier Sold in China for $16mln," *Sputnik International,* 31 May 2006, sputniknews.com/.