

H-005-2

Samuel J. Cox, Director of Naval History

18 Apr 17 (2019 re-issue)

Carrier vs. Carrier (Us vs. Them.)

The greatest advantage the Japanese had in the first months of the war was the ability to quickly launch a massive multi-carrier coordinated and integrated strike package, under a single strike commander, and conduct a well-timed, coordinated, multi-axis attack on the target. At the Battle of Midway, the Japanese launched a 108 plane strike from four carriers in seven minutes, formed up and enroute to the target (Midway Island) in 15 minutes, with a 107 planes in reserve to be launched against U.S. carriers should they be detected. Japanese doctrine (like the U.S., frequently violated) called for each carrier to launch half its aircraft, that would form up into a single strike package under a single strike leader, while the other half of each carrier's air wing was held in reserve for contingency or to launch a second wave (as at Pearl Harbor.) The U.S. could not remotely duplicate this feat, taking close to an hour to launch a similar size strike (90 aircraft) from two carriers that proceeded to the target (the Japanese carriers) in widely separated and uncoordinated groups. Both the Japanese and the U.S. could spot about half their air group for a launch. By integrating the aircraft from multiple carriers into one strike package, the Japanese could complete the launch and push to the target much faster than the U.S. The Japanese could then re-spot the deck for a second wave, or to await updated contact information. The American approach required the first half of the strike package to orbit and wait for the second half to be spotted and launched, and the second spot almost always had some complication that resulted in delay, and a serious fuel shortage amongst the aircraft from the first spot.

U.S. doctrine (like the Japanese, frequently violated) called for each carrier and escorts to operate as an independent task force, and for each air group to launch their full complement of aircraft in an independent strike, that might be loosely coordinated in timing with another carrier air group. The principle advantage of this approach was that it kept the enemy from finding (and destroying) all the carriers at once. The major disadvantage was that it frequently resulted in uncoordinated strikes and diffused combat air patrol (fighter) defense. The Japanese were even more fixated on the Mahanian principle of offense, and determined that massing their carriers into a single task force gave them the greatest offensive punch, and also allowed them to mass their fighters into a more coordinated defense. Debate regarding which approach was better raged in both navies prior to the war. The U.S. approach nearly cost the U.S. victory at Midway. The Japanese approach significantly contributed to their defeat at Midway.

In the Japanese Navy, a Carrier Division (two carriers) was a highly trained integrated tactical formation, unlike in the U.S. where a Carrier Division was mostly an administrative function. CARDIV 1 (Akagi and Kaga), CARDIV 2 (Hiryu and Soryu), and CARDIV 5 (Shokaku and Zuikaku) constituted the Kido Butai (Mobile Striking Force.) Each CARDIV could operate independently, but splitting a CARDIV (or crippling one of the two carriers) resulted in a severe degradation in combat capability, which is what happened at Coral Sea, and what prevented Zuikaku from participating at Midway.

Numbers:

U.S.: At the outbreak of WWII, the U.S. had seven aircraft carriers. The Langley (CV-1) had been converted to a seaplane tender and was lost off Java in Feb 42 and is not counted. Ranger (CV-4,) the first U.S. carrier built from the keel-up as a carrier, was not considered capable of operating as a front-line carrier against the Japanese, but did provide useful service in the Atlantic. The Lexington (CV-2) and Saratoga (CV-3) were converted battlecruiser hulls and had served in the Pacific since being commissioned in 1927. Saratoga was torpedoed by Japanese submarine I-6 in Jan 42 and was out-of-action until June 42, missing the battle of Midway, although significant parts of her air group did participate as replacements on board Yorktown. Lexington was sunk on 8 May 1942 in the Battle of the Coral Sea. The Wasp (CV-7) was a one-of-a-kind design (treaty-limited) that was not considered especially successful; she served in the Atlantic until Jul 1942 (including flying off British Spitfire fighters to assist in the defense of Malta) before arriving off Guadalcanal to operate briefly before being torpedoed and sunk by Japanese submarine I-19 on 15 Sep 42. The three Yorktown-class carriers (Yorktown (CV-5), Enterprise (CV-6), and Hornet (CV-8) were arguably the most-capable and best-designed of any carrier in any navy to that date. Yorktown and the new Hornet were in the Atlantic at the start of the war and were brought around to the Pacific. Yorktown was damaged at Coral Sea, quickly repaired, and then heavily damaged by Japanese dive bombers and torpedo bombers from the Japanese carrier Hiryu before being torpedoed and sunk by Japanese submarine I-168 at the Battle of Midway. Hornet was sunk at the Battle of Santa Cruz in Oct 1942, while Enterprise survived the war as the most highly-combat-decorated U.S. ship in history. During WWII the U.S. commissioned 17 new Essex-class carriers, 9 new Independence-class light carriers (on converted light cruiser hulls) and over 100 smaller and much slower escort carriers; demonstrating a U.S. industrial shipbuilding capacity that the Japanese could not remotely match (in part, because of U.S. submarines sinking Japanese merchant ships carrying critical raw materials.)

Japan: Japan began the war with 10 carriers, but only six were large "fleet" carriers comparable to the U.S. carriers, the others were a hodgepodge of medium and light carriers based on converted submarine tenders and other vessels, with limited capabilities. Like the

Lexington and Saratoga, the Akagi and Kaga were 1927/28 vintage converted battlecruiser (Akagi) and battleship (Kaga) hulls. Like the Yorktown-class, the newer (late '30's vintage) Hiryu and Soryu were smaller than the converted carriers, but were very capable and very fast. Akagi, Kaga, Hiryu and Soryu were all sunk at the Battle of Midway. The newest Japanese fleet carriers Shokaku and Zuikaku were highly capable and the most successful Japanese carrier designs of the war; the Pearl Harbor strike was essentially the shakedown cruise for Zuikaku. Both survived numerous battles before being sunk; Shokaku by U.S. submarine USS Cavalla (SS-244) at the Battle of the Philippine Sea (Jun 44) and Zuikaku by U.S. aircraft at the Battle of Leyte Gulf (Oct 44). During the war, Japan only produced one large fleet carrier that made it into battle, the Taiho, sunk by U.S. submarine USS Albacore (SS-218) at the Battle of the Philippine Sea. The Shinano, a conversion from the third huge Yamato-class battleship hull, was sunk by USS Archerfish (SS-311) in Nov 44 before she had even commenced sea-trials. Several other fleet carriers were in various stages of (mostly suspended) completion when they were bombed, sunk or damaged by U.S. carrier aircraft in Japanese home ports in the last months of the war.

Carrier Air Groups (In the USN, Carrier Air Groups became Carrier Air Wings in 1963).

U.S.: USN carriers could generally carry more planes than Japanese carriers, and the USN was willing to keep numerous planes parked on the flight deck, so USN air groups were larger, with 60-70 aircraft. In the first years of the war, USN air groups typically consisted of one fighter squadron (VF) of 18 F-4F Wildcats, one squadron (VT) of 12-18 TBD Devastator torpedo bombers, and two squadrons of SBD Dauntless dive bombers (16-21 aircraft each.) One of the SBD squadrons was designated as a "Bombing" squadron (VB) and the other as a "Scouting" squadron (VS.) In practice, there was little difference in the employment of the VB and VS squadrons; sometimes the VB would carry 1,000lb bombs (with shorter range) and the VS would carry 500lb bombs (with longer range) but both could do either. The USN was generally fixated on the bombing capability and neglected scouting "ISR" capability (with significant negative effects in several battles) despite extensive exercise experience that showed that whichever carrier force found the other first had a decisive advantage.

Initially, the numerical designation of each USN squadron matched the hull number of its parent carrier (torpedo squadron eight (VT-8) embarked on USS Hornet (CV-8) for example.) An exception to this at Coral Sea was that the fighter squadron on Yorktown (CV-5) was VF-42 (the rest of the air group as VB-5, VS-5 and VT-5.) The system began to further fall apart at Midway, when some Saratoga (CV-3) squadrons replaced battle-attrited Yorktown squadrons (VT-3 replaced VT-5 and operated off Yorktown (CV-5) at Midway for example.) Air Groups were known by their parent carrier (e.g. "Enterprise Air Group") until later in 1942 when a number corresponding to the parent carrier was implemented (CAG 6 embarked on USS Enterprise (CV-

6) for example.) The whole system got too complicated and was abandoned during the war; air groups and squadrons thereafter retained their number regardless of which carrier they were embarked on.

Japan. Although Japanese carriers had two hangar decks (an upper and a lower), the Japanese did not keep planes parked on the flight deck as the U.S. did. As a result, Japanese air groups were smaller, roughly 50-60 operational aircraft. A typical Japanese carrier would carry 18 Mitsubishi A6M2 Type 0 fighters (code-named "Zeke" but usually referred to as "Zero"), 21 Aichi D3A1 Type 99 "Val" dive bombers and 21 Nakajima B5N2 Type 97 "Kate" torpedo bombers, which could also be used as high-altitude horizontal bombers. (The "Type XX" referred to the imperial calendar year in which the aircraft was introduced. The "Zero" (actually "00") derived from imperial year 2600, which corresponded to 1940.)

The basic unit of Japanese naval aviation organization was a three-plane "shotai" and nine-plane "chutai." A Japanese rough equivalent to a "squadron" would generally consist of some multiple of three/nine, such as 18, 21, 27 aircraft. Unlike U.S. air groups, Japanese air groups and associated maintenance personnel, were all integral "ship's company." The Japanese did not have the capability to rapidly shift groups or squadrons from carrier to carrier such as the U.S. did just before Midway, by putting squadrons from the Saratoga (left on the beach in Hawaii after she was torpedoed) onto the Yorktown, to replace and/or supplement losses incurred by Yorktown's squadrons at Coral Sea. By contrast, even though the Zuikaku was undamaged at Coral Sea, the Japanese were unable to "cross-deck" and combine remnants of Shokaku and Zuikaku's air wings into an effective force in time for the Battle of Midway, so the undamaged Zuikaku missed Midway too because she could not reconstitute an air wing in time (although a case could be made that the over-confident Japanese didn't try hard enough to do so). Also, although combat losses in the months after Pearl Harbor were low, operational attrition was already outstripping Japanese ability to replace aircraft. So at the Battle of the Coral Sea, all Japanese carriers had fewer embarked aircraft than their maximum complement. The same was true at Midway, but compensated by additional Zeros that had been embarked intended to be ferried to and flown from Midway after the Japanese captured it, according to the Japanese plan. The Japanese were even more fixated on bombing instead of scouting than the U.S., preferring to leave the "search" mission to catapult-launched float planes from cruisers and battleships, and long-range flying boats, as much as possible. Using carrier aircraft to conduct searches was viewed as a "waste" of an attack asset, even though the Japanese too clearly understood that whichever side found the other first would almost always "win" the exercise. Like the U.S., the Japanese frequently paid for their inadequate attention to "ISR," dearly at Coral Sea and Midway

Plane vs. Plane.

Fighters: The F-4F Wildcat was significantly inferior to the Japanese Zero fighter in terms of maneuverability, dogfighting capability, and range. Wildcats that attempted to “mix-it-up” with Zeroes usually met a quick end. However the Wildcat had more powerful armament, more armor, self-sealing gas tanks, much better radio, and could withstand a lot more punishment than a Zero, which tended to turn into a flaming torch when hit with a few rounds. With the right tactics (stressing teamwork and diving one-pass hit-and-run) and experienced pilots, Wildcats could make it an even fight. If the Wildcats could get through the Zeros (or better yet, avoid them) they were quite capable of downing numerous Japanese dive and torpedo bombers.

Torpedo Bombers: At the start of the war, both U.S. and Japan viewed torpedoes as the true ship-killers (correctly.) When the TBD Devastator entered the fleet in 1937 it was the most advanced, state-of-the-art carrier bomber in the world. By 1942, it had been surpassed in capability by the much better Japanese B5N2 “Kate.” Comparison between the TBD and the Kate is somewhat meaningless since they didn’t fight each other. How they stood up to enemy defenses, particularly fighters, is what mattered. The Kate was faster, and had a much better torpedo that could be dropped from higher altitude and at faster speed than the TBD, which gave it a significant survivability advantage. However, if Wildcats could make the intercept, Kates would go down in flames even more readily than a TBD. The most critical weakness of the TBD was its torpedo, which required the TBD to fly even slower than the TBD’s too-slow maximum speed, and to fly so low that the TBD could not maneuver, and the torpedo was so slow (35kts) that most target ships could easily outrun it. Faced with a torpedo attack, Japanese carriers would generally turn away at high speed, forcing the torpedo planes to make a very long run to get ahead of the carrier, providing much more time for the fighters to engage. Like their sub and surface-launched counterparts, U.S. airdropped torpedoes frequently failed to detonate properly even when they hit the target.

Dive Bombers: Both the SBD Dauntless and Val dive-bombers were great aircraft superbly suited to their mission. The Val looked like a throw-back with fixed landing gear, but its performance approximated that of a SBD, but with longer range and smaller (but effective) payload. The Val’s lack of folding wings was one factor that constrained Japanese air group size. Like the Wildcat, the SBD was a rugged aircraft that could absorb considerable punishment (which increased the vulnerability of attacking Zeros to defensive fire.) The SBD was maneuverable enough that in some U.S. air wings it was used in an anti-torpedo bomber role (and anti-submarine role.)

Anti-Aircraft Defense. At the outset of WWII, U.S. carrier AAA defense was very poor. Japanese carrier AAA defense was even worse. Neither side had weapons that were effective against dive bombers, and only marginally effective against torpedo bombers. In most cases,

defensive weapons lacked the range to effectively engage the target aircraft before bomb or torpedo release. At both Coral Sea and Midway, the vast majority of losses on both sides were due to enemy fighters (and running out of fuel). Only a minimal number were lost to AAA fire. By the time of Coral Sea and Midway, U.S. carriers and some cruisers were equipped with radar. No Japanese ships had radar at either battle. Radar-directed fighter control was still in its infancy, but was used effectively by the U.S. in several instances, but was easily overwhelmed in a mass attack. The U.S. kept cruisers and destroyer escorts in a circular formation close to the carrier to theoretically provide supporting AAA fire (later in the war, with better weapons, this worked well, but early in the war this generally only resulted in increased risk of collision once the carrier started maneuvering to avoid bombs and torpedoes, and Japanese aircraft easily found the gaps between ships.) The Japanese, on the other hand, viewed radical maneuver as the best carrier defense against air attack (besides the fighters) and Japanese escorts would steer well clear to give the carrier plenty of sea room to maneuver. Japanese escorts also didn't have enough AAA to defend themselves, let alone a carrier. Also, because of lack of radar, Japanese escorts were stationed farther from the carrier, at the horizon, to provide visual early warning of incoming raids. Upon detecting a raid, the escort would fire its main battery to alert the airborne fighters to the direction of attack, since the few radios the Japanese had in their fighters were very unreliable.

Damage Control: U.S. damage control was greatly superior to the Japanese, although many hard lessons were learned from the loss of the USS Lexington at Coral Sea (and from the disaster at Pearl Harbor for that matter). In the years since, many Sailors have spent many hours chipping paint to prevent the buildup that fueled horrific fires on U.S. ships early in the war. The U.S. also incorporated lessons learned much faster than the Japanese. As an example, at Midway, the Yorktown flooded her aviation fuel lines with inert CO2 gas, almost certainly sparing her the secondary explosions that doomed the Lexington at Coral Sea. The Japanese learned the vulnerability of the aviation fuel lines on Shokaku at Coral Sea, but were able to save the ship, but then didn't pass the lessons on, contributing to the loss of four carriers at Midway.

On Japanese carriers, damage control was the responsibility of a specially trained cadre of engineering personnel (who were frequently killed by initial and secondary explosions) and no one else had received training. The result was that fires would be fought ineffectively by untrained crew with extraordinary valor and extremely high cost in lives. The Japanese had also not developed the system of "damage control conditions" that the USN had (they had no equivalent to Yoke, Zebra, etc., nor did they have an effective "damage control central.") A critical design weakness of the Japanese carriers was that their hangar bays were completely enclosed. U.S. hangar bays had rolling partitions that could be opened to the weather, which enabled aircraft engines to be warmed up in the hangar bay; Japanese carriers had no such

thing. The Japanese also fueled their aircraft in the hangar bay, then took the aircraft to the flight deck to warm up (U.S. carriers fueled aircraft on the flight deck.) As a result, an explosion in a Japanese hanger bay would be unable to easily vent out of the ship as on a U.S. carrier, and in combination with fueled aircraft would have devastating consequences, which proved to be the case at Midway.

The theme that runs throughout the above was that the Japanese viewed "Offense" as the supreme virtue, and disdained "Defense" to their ultimate detriment. It worked well for the first six months of the war, then proved catastrophic.