Fire from the Skies
Designers Notes

Fire from the Skies brings aircraft to *Fire on the Waters*, with an emphasis on aircraft carrier battles. This game tries to capture some of the critical capabilities and constraints that carrier task force commanders faced. During World War II aircraft carrier capabilities and tactics varied by nation and by time. The first installment of *Fire from the Skies* focuses on Japanese and American carrier operations in the first year of the Pacific War.

The Great Gamble.

World War II aircraft carrier warfare was a great gamble in two distinct ways.

First, while navies had operated carriers for two decades before the start of the Second World War, they had never blooded them in combat. The three great navies of the interwar period – those of the United States, Great Britain, and Japan – had all bought into the idea that carriers would be an important part of naval strength, but none of them could know how with certainty how that idea would work in practice. The three navies were gambling that their designs, operational practices, and tactics were going to be effective in a shooting war.

Second, the conclusions that these navies had drawn from theoretical contemplation and peacetime maneuvers pointed to carrier warfare being risky in the extreme. Carriers looked to be the ultimate "eggshells armed with hammers:" ships with an offensive potential far greater than their ability to defend themselves. That perception implied that carrier warfare was likely to be violent and quick, and that the combat life of a carrier was likely to be short.

Diverging Designs

The main users of carriers spent a lot of time and money developing the ships and their aircraft. Development began in the early 1920s (with even earlier origins), and continued to the start of war and beyond. The navies pushed ahead with theoretical discussions, abstract war games, and operational maneuvers. They adopted and discarded ideas and concepts. But they could never know just how their new weapons would actually work under real combat conditions until combat was joined. How much damage would their strike aircraft do? How much havoc would defending fighters and antiaircraft guns wreak in return? Had they struck the right balance of aircraft range and sturdiness? Weapon load and performance? Were their tactical doctrines right? Their balance of offense and defense? Priority of targets? Strike make-up? Arming cycles? All of this was discussed before the war, but no one knew how these things would work out in practice.

Because no one could be certain of the right answers to these questions, the start of the war saw a wide divergence in equipment and practices between the navies. Some of this was due to the context in which each navy's carriers would operate, but still more was due to longstanding uncertainty about just how carrier warfare would look.

The British faced the need to use their carriers in relatively confined waters of the Mediterranean and the wide open spaces of the South China Sea. They opted for ship protection over strike power. Relatively small striking power meant that the British saw carriers as auxiliaries to the fighting line – useful for scouting and harrying the foe, but unlikely to generate decisive killing power on their own. The British believed that their carrier aircraft would either operate beyond the reach of land-based fighters or in an environment in which the RAF had neutralized land-based air, so they did not feel pressured to develop high performance carrier aircraft. Instead, their aircraft designs stressed payload and ease of operation. Because of their envisioned role of damaging and slowing enemy capital ships, the British strike aircraft focused on torpedo attacks.

The Americans emphasized speed and size of their carrier air strikes. While there was no consensus in the USN about the carrier as a war-winner, there was a broad recognition that a force with operating carriers would have a significant advantage over a force without. For most of the interwar period, the USN thought that there was little to be done about carrier vulnerability; they believed that offense was the best defense in carrier operations, and that offense should first be aimed at the enemy carriers. Their ships carried large numbers of strike aircraft, and their operating procedures emphasized quickly sending a large "power pulse" to wipe out the enemy air capability, then dealing with other enemy ships at leisure. By 1941, their favored weapon had become the dive bomber, which could rapidly tear up enemy flight decks even if it did not sink enemy carriers outright.

The Japanese also recognized that carriers might be very vulnerable to air strikes, but their response differed from the Americans. The Japanese took a page from their naval surface warfare book, and developed the doctrine of outranging – striking from beyond the range of the enemy aircraft. This required good scouting forces, which the Japanese developed in the form of very long ranged land-based bombers and flying boats. The Japanese opted for balance in the make-up of their carrier air group, generally carrying equal numbers of fighters, dive bombers, and torpedo bombers in their fleet carriers. But their torpedo bombers were their ship-killers; their dive bombers carried only about half the payload of the Americans'.

Risk Tactics

While the navies varied in their carrier doctrines, they generally were alike in viewing the carrier as a weapon that could dish out far more than it could take.

Being mobile airfields, carriers were packed with highly flammable aviation gas and highly explosive bombs and torpedoes. And even if they didn't burn or blow up, a few bombs on their flight decks might ruin their ability to conduct flight operations.

The potential for surprise compounded this situation. Before carriers, surprise in naval warfare flowed largely from maneuver – bringing the larger part of your force against the smaller part of the enemy's force at the point of contact. Once battle was joined, tactics of surprise became secondary to deploying ships' guns to best effect. Then followed a battle of attrition as ships pounded ships.

Carriers changed that picture in two ways. First, a single carrier's aircraft might be able to put out enough power in a single strike to cripple or sink one or perhaps two enemy carriers, all in a matter of minutes. Second, a carrier could strike without being struck in return, if it remained unlocated or if the enemy carriers struck at other targets. Because carriers could detect their enemy and launch powerful strikes without revealing their positions, they could decisively defeat a larger carrier force by surprise attack. Two battleships fighting four battleships of equal combat power were almost certainly doomed to defeat, but two carriers fighting four equal carriers might win – and win decisively – if they could avoid the enemy's counterblow.

A study in probability demonstrates this. Assume that a carrier can launch two simultaneous strikes from its air group, each with a 75% chance of putting an enemy carrier out of action. What are the predicted results of a one carrier versus two carrier battle? If the stronger side strikes first, it has better than a 99.5% chance of wiping out the enemy carrier without loss. If the two sides exchange strikes, the stronger side still has a 99.5% chance of killing the single enemy carrier, but that one carrier would on average take out one and a half of the stronger side's two carriers – the "weaker" side inflicts more damage. If the weaker side struck first, it would still on average take out one and a half of its two opponents, and would have a 41% chance of being mauled itself – an expected kill ratio of about 3.5 to 1. Obviously, the more that the weaker side could do to strike first or trade strikes, the better for it. Conversely, the strength of the stronger side would be no guarantee of victory unless it could strike first.[1]

This tactical picture translated into extreme stress for the carrier commander. He had to balance striking power with scouting ability. Too little of the latter and the strike would never find a target; too much and striking power would be diminished. Striking the right target also became very important. If the carrier

[1] In contrast, conventional thinking for battleship combat was that the sides would inflict losses based on the square of the proportion of their strengths. For example, four battleships fighting two would be expected to have a margin of four to one – four squared (16) to two squared (4). In this model, relatively slight differences in strength gives the stronger force a disproportionate advantage over the weaker force. For example a force of 9 ships fighting 7 would be expected to have an advantage of about 8 to 5.

commander sent his aircraft after non-carrier targets, he might find his own carriers wrecked before he could relaunch his own aircraft against the enemy carriers. This made timing key; he who acted first, on the best information available, would be first to strike a winning blow. The trick was to decide when the commander had enough information to act. And the commander could only know that his decision was right well after the time that he was called upon to make it.

Simulating Uncertainty

I spent much of the development time for *Fire from the Skies* on creating a blind system that created the fog of war facing carrier commanders. This fog revolved largely around sighting reports. During this era, reconnaissance was an inherently risky business. Search aircraft could fail to see forces, could see them but misreport their composition, could get their positions wrong, or could have their own search reports delayed, garbled in transmission, or simply lost in the ether. The bane and burden of the carrier commander was to make rapid, right decisions based on incomplete, conflicting, and delayed information.

FFTS simulates this through a sighting card system. Players use card decks to build card hands for each of their task forces. As a task force is sighted, the opposing player is able to look at some of the cards in the task force's hand. The cards are reviewed through a process in which the task force player does not see which cards the searching player has seen and the searching player knows only the cards that he or she has seen. Dummy task forces and dummy ships compound the uncertainties.

Search results in hand, the players plot and launch strikes. Only as a strike arrive at their designated strike locations does the striking player need to reveal its target.

The Mechanics of Carrier Operations

FFTS goes further than other carrier simulations in trying to model the mechanics of carrier operations. It pays attention to the fact that larger aircraft with heavier loads had to be positioned further back on the flight deck to take off. It considers aircraft size in determining how many aircraft of which type can be placed in which deck locations. It deals with aircraft readying times based on what is being readied and who is doing the readying. It uses a more detailed model of carrier damage than most other simulations.

This installment of *FFTS* also considers the nuances of Japanese and American carrier design that shaped the ways in which both sides fought. For example, the American player must learn to cope with the American practice of permanent deck parks – his carriers generally have more aircraft than they can store in their hangers. This kept the Americans busy during flight operations, shuttling parked

aircraft forward and backward as other aircraft landed or took off. Similarly, a player with Japanese carriers must deal with the longer ready times that those carriers had due to a limited ability to arm aircraft on their flight decks. While American aircraft shuttled forward and back along their flight decks, Japanese aircraft rode up and down on elevators between flight deck and hanger deck.

Reality-Based Results

As much as I could, I based combat results in the game on historical results. I based air to ship hit percentages on the results that the sides actually achieved. Air combat results were based on the outcomes of the battles fought during this time period. Anti-aircraft values are designed to yield losses similar to those experienced historically. Wherever possible, I tried to build probabilities based on what had actually happened, rather than on a theoretical construct.

A look at the record can yield some surprising results. For example, it would be logical to think that the Americans, with the advantage of radar, would have been much better at putting defending fighters in the way of enemy strikes. But in fact, the historical record shows that the Japanese were equally successful in intercepting the enemy. I can only speculate on the reasons why, but I suspect that it had something to do with the relatively more agile Japanese fighter aircraft, the Japanese practice of putting their escort screen at a distance from screened to spot and warn of incoming strikes, and, on average, slower Allied strike aircraft. And Allied radar interception techniques were in their infancy during this period.

A Note on Sources

I consulted many sources in designing *FFTS,* and I do not propose to list them all here. For the player interested in the history behind the game, I do recommend the following from among the many worthwhile books on the subject.

Lundstrom, John B. *The First Team: Pacific Naval Air Combat from Pearl Harbor to Midway*

The First Team and the Guadalcanal Campaign: Naval Fighter Combat from August to November 1942

While these two books focus on USN carrier fighters, they provide invaluable insights into carrier operations in the period and detailed, meticulously researched accounts of the carrier battles of the period. Just the account of Thach's fight at Midway or the Enterprise's travails at Santa Cruz is worth the price of admission.

Peattie, Mark R. *Sunburst: The Rise of Japanese Naval Air Power,*

1909-1941

While Peattie's purpose is to examine the evolution of Japanese naval air power before December 1941, much of the information he provides on operating principles and carrier and aircraft design are equally applicable to the early war period. And in fact Peattie does not end his narrative in 1941; he also examines the downfall of Japanese naval aviation.

Parshall, Jonathan and Tully, Anthony — *Shattered Sword: the Untold Story of the Battle of Midway*

Parshall and Tully do a painstaking job of examining the battle of Midway from the perspective of Japanese carrier capabilities, doctrines, and tactics. They provide extremely useful insights into how these factors combined with the events of the day to affect the outcome of the battle.

Hone, Thomas C, Norman Friedman, and Mark D. Mandeles — *American and British Aircraft Carrier Development, 1919-1941*

This book also focuses on the interwar years, but again with considerable relevance for the Pacific naval war in 1942. The authors give a good sense of the choices confronting the carrier theorists and tacticians of the interwar era, and why choices were made in the way that they were.

Willmott, H. P. — *The Barrier and the Javelin: Japanese and Allied Pacific Strategies, February to June 1942*

A good in-depth look at the events leading to, and following from, the battles of the Coral Sea and Midway. Wilmott's various conclusions can be disputed, but he does an excellent job of setting these battles in their historical context and exploring the choices confronting the contending commanders.