

## How WWII Fighter Planes Worked

"A date that will live in infamy." That is how U.S. President Franklin D. Roosevelt described December 7, 1941. On that fateful day, a little before 8:00 a.m., the Empire of Japan attacked Pearl Harbor in a preemptive strike meant to cripple the United States before they could join the Allied Forces in World War II. The Pearl Harbor raid was successful, resulting in the loss of 2,403 American lives, as well as the destruction or damage of 21 U.S. ships and 347 U.S. aircraft. The key to this successful attack was the Japanese aircraft, particularly the **Mitsubishi A6M Type 0 fighter**, commonly known as the **Zero**.

Photo # 80-G-182252 Japanese "Zero" fighter leaves Akagi to attack Pearl Harbor, 7 Dec 1941



Photo courtesy Naval Historical Center  
**Mitsubishi Zero fighter planes like this one were the heart of the Japanese aerial force that attacked Pearl Harbor.**

World War II was often a battle of technological advances. Throughout the war, the Allied and Axis forces constantly worked to improve the abilities and features of their equipment. No type of technology showcased this battle for supremacy better than the fighter planes. Every few months saw the introduction of a new or improved fighter plane to combat the latest version developed by the opposing side.



Photo courtesy National Museum of Naval Aviation  
**This Zero is on exhibit at the National Museum of Naval Aviation.**

In this edition of [HowStuffWorks](#), we will take a look at the basics of these fighter planes, focusing on the Japanese Zero used at Pearl Harbor. You'll learn about the infrastructure of the planes, how they were used and the types of weapons they carried. But first, let's see how the Japanese planes got to Pearl Harbor in the first place...

### The Deep Blue Yonder

On November 26, 1941, 30 Japanese ships and a separate fleet of [submarines](#) departed the Kurile Islands (also spelled "Kurile") in the North Pacific on a course for Hawaii. The Japanese fleet was based around six **aircraft carriers**, huge ships capable of carrying a large number of [planes](#) and providing a place for them to take off and land.

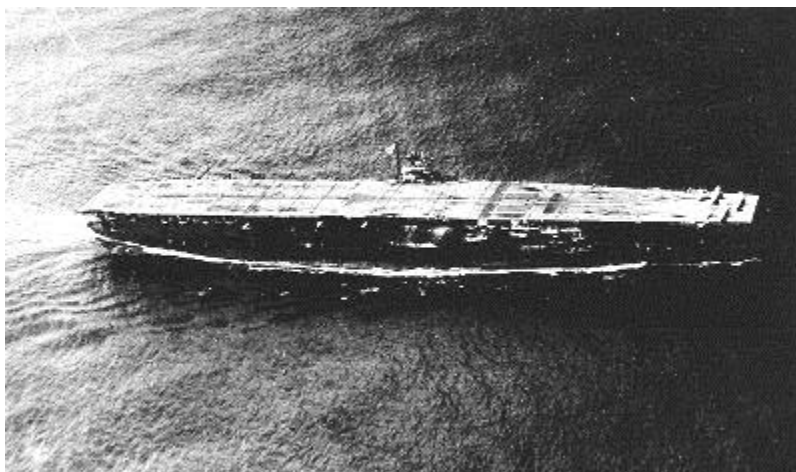


Photo # NH 73059 Japanese aircraft carrier Akagi in Summer of 1941

Photo courtesy Naval Historical Center  
**The Japanese aircraft carrier Akagi was one of six that were sent to Pearl Harbor.**

Between the six carriers, they had a combined total of 420 planes, including:

- **Fighters** - These planes were the most versatile, capable of air-to-air combat with enemy planes as well as air-to-ground combat. Fighters carried a few bombs but mostly relied on cannon and machine guns.
- **Dive bombers** - These planes were designed to carry bombs that could be released quickly at a specific target as the plane dove toward the target. After releasing the bombs, the plane would veer back up into the sky.
- **High-level bombers** - These large planes flew high over a target area and dropped several bombs, essentially blanketing an area. While it was not easy to target a specific object, such as a building, the sheer number of bombs dropped greatly increased the chance of hitting the object.
- **Torpedo bombers** - These planes carried [torpedoes](#) that they dropped into the ocean on a trajectory intended to hit a ship or submarine.

Photo # 82-G-7-198 Japanese planes prepare to take off to attack Pearl Harbor, 7 Dec. 1941



Photo courtesy Naval Historical Center  
**Japanese fighter planes preparing to launch from the deck of an aircraft carrier**

When the Japanese fleet was a little less than 300 miles (483 km) north of Pearl Harbor, the first wave of 181 planes was launched. This wave left the carriers at approximately 6:00 a.m. on December 7, 1941, and consisted of planes of all four types listed above. About half an hour after the first wave departed, another wave of about 170 planes was launched. The biggest difference between the two waves was that the second wave contained no torpedo bombers and more dive bombers.



Photo courtesy Naval Historical Center  
**Japanese aircraft are prepared for takeoff.**

On the next page, we will examine how these planes worked.

### Zero Fighters

Fighter planes, both then and now, are designed for maneuverability and speed. The main goal of a fighter is to shoot down other airplanes, but a fighter can use its weapons to do a lot of damage on the ground as well. While some of them carried a small number of bombs, the primary offensive weapon of a fighter during WWII was the **machine gun**.

At the beginning of the war, the Japanese Zero fighter was an incredibly good fighter compared to the competition. It had three key strengths:

- Speed
- Maneuverability
- Range

The speed came from a powerful 14-cylinder radial engine. This engine had two banks of seven cylinders and generated around 1,000 [horsepower](#). The engine gave the Zero a top speed of 330 MPH, although its normal cruising speed was just over 200 MPH. The aircraft also had retractable landing gear to reduce drag.

The maneuverability came from the fact that the Zero was a small, light plane. It was made of lightweight aluminum and weighed approximately 3,700 pounds empty (about 6,000 pounds fully loaded with pilot, fuel and ammunition). The wingspan was just shy of 40 feet, and the length just shy of 30 feet. To get an idea of how big this is, you can compare it to a Cessna 152. The Cessna is a small plane commonly used today for pilot training -- you see these little planes at any small airport. The Cessna 152 is about as small as small planes get, and it has a wingspan of 33 feet and a length of 24 feet. The Zero was not much bigger, but had about ten times the horsepower of the Cessna and an incredibly strong airframe.



Especially at lower speeds, the Zero had an extremely small turning radius. The ability to make sharp turns let it outmaneuver any other fighter. At higher speeds, however, the maneuverability decreased. See [this page](#) for details.

Range came from large gas tanks. The Zero could carry about 150 gallons (almost 600 liters) of gasoline, as well as another 94 gallons (355 liters) of gasoline in an external drop tank. This gave it a range of 1,200 miles (almost 2,000 miles with the external tank).

The Zero had three types of armament:

- Two 7.7 mm machine guns on the fuselage (500 rounds each)
- Two 20 mm cannons on the wings (60 rounds each)
- Two small, optional bombs weighing about 130 pounds each.

The Zero was not perfect. As mentioned above, it lost maneuverability at high speed. The pilot was totally unprotected by armor, the fuel tanks were thin and light, and there was nothing onboard to extinguish a fire. These omissions kept the plane lightweight, but made it fragile -- it did not take much to shoot down a Zero.

The following charts summarize the Zero's stats:

Name	Designation	Manufacturer	Weight (fully loaded)	Wingspan	Length
Zero	A6M	Mitsubishi	5,828 lb (2,644 kg)	39.3 ft (12 m)	29.7 ft (9.1 m)
<b>Maximum Speed</b>		<b>Maximum Altitude</b>		<b>Maximum Range</b>	
336 mph (541 kph)		32,000 ft (9,754 m)		1,200 mi (1,932 km)	
Engine	Machine-gun Size	Machine-gun Location (Number)	Cannon Size	Cannon Location (Number)	Bomb Capacity
Sakae 21 radial 1,030 hp	7.7 mm	Fuselage (1) Wings (2)	20 mm	Outer wings (2)	2 @ 132 lb (60 kg) each

The Japanese Zero fighters dominated the Pearl Harbor attack, strafing ships and airfields with machine-gun fire. Due to the complete surprise of the attack, the United States had very few planes actually make it off the ground. The majority of the planes that were stationed at Pearl Harbor were Curtiss P-36 Hawks and Curtiss P-40 Warhawks.

On the next page, we'll take a look at the Japanese bombers used in the raid.

### Bombers

The bombs used by the Japanese planes were fairly simple devices. They did not have any onboard guidance or propulsion systems like you would find in a [missile](#). Instead, they relied on gravity and inertia to provide the speed, and on manual targeting by the aircraft pilot for guidance.

Photo # NH 50930 Japanese aerial photo of Pearl Harbor under attack, 7 Dec. 1941, looking east



Photo courtesy Naval Historical Center  
**This photo from a plane above Pearl Harbor shows the impact of bombs on ships and the water.**

Photo # 80-C-19030 Rescuing survivor near USS West Virginia during Pearl Harbor raid



Photo courtesy Naval Historical Center  
**Japanese dive bombers severely damaged the battleship USS West Virginia.**

The dive bombers were the biggest threat to U.S. forces. Each bomber came barreling out of the sky in a steep dive towards a target. When the plane was a few hundred feet away from the target, the pilot pressed a button to release the bomb. Each bomb was attached to a rack or rail and held in place with a simple latch mechanism. When the latch was opened, the bomb slid off the rail or dropped off the rack. If the pilot timed the release correctly, the bomb hit the target moments after the plane veered away. Upon impact with the target, a percussion cap in the nose of the bomb ignited a small amount of explosive matter. The resulting small explosion set off the main explosive in the bomb, causing it to detonate.



Image courtesy David Llewellyn James Pengam  
**The Aichi D3A "Val"**

Name	Designation	Manufacturer	Weight (fully loaded)	Wingspan	Length
Val	D3A	Aichi	8,047 lb (3,650 kg)	47.2 ft (14.4 m)	33.5 ft (10.2 m)
<b>Maximum Speed</b>		<b>Maximum Altitude</b>		<b>Maximum Range</b>	
242 mph (390 kph)		31,170 ft (9,500 m)		1,131 mi (1,820 km)	
Engine	Machine-gun Size	Machine-gun Location (Number)		Bomb Capacity	
Kinsei radial 1,075 hp	7.7 mm	Rear cockpit (1) Wings (2)		2 @ 66 lb (30 kg) each 1 @ 551 lb (250 kg)	

The high-level bombers operated much differently from the dive bombers. They flew well above the attack point and dropped multiple bombs at a time, blanketing the area. Again, these bombs relied on gravity for their propulsion and did not have any type of guidance.

The bombs dropped by the torpedo bombers did use both propulsion and guidance. Torpedo bombers are very effective in air-to-sea combat. Like dive bombers, torpedo bombers swoop down toward their target; but they drop their bomb well before they reach the target. The bomb, a [torpedo](#) similar to the kind fired by [submarines](#), speeds through the water toward the target.

The charts below show the capabilities of the primary torpedo bomber used by Japan in the Pearl Harbor attack.



Image courtesy David Llewellyn James Pengam  
**The Nakajima B5N "Kate"**

Name	Designation	Manufacturer	Weight (fully loaded)	Wingspan	Length
Kate	B5N	Nakajima	8,047 lb (3,650 kg)	51 ft (15.5 m)	34 ft (10.4 m)
<b>Maximum Speed</b>		<b>Maximum Altitude</b>		<b>Maximum Range</b>	
217 mph (349 kph)		25,000 ft (7,620 m)		683 mi (1,099 km)	
<b>Engine</b>	<b>Machine-gun Size</b>	<b>Machine-gun Location (Number)</b>		<b>Bomb Capacity</b>	
Hikari 3 radial 770 hp	7.7 mm	Rear cockpit (1)		2 @ 551 lb (250 kg) ea 6 @ 132 lb (60 kg) ea	

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- [Naval Air War in the Pacific](#)
- [Japanese Forces in the Pearl Harbor Attack](#)
- [Mitsubishi AM6 Zero Fighter](#)
- [Zero](#)
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