How Aircraft Carriers Work

Photo courtesy U.S. Department of Defense

The USS George Washington, one of the U.S. Navy's nuclear-powered super aircraft carriers

When the U.S. Navy really needs to impress people, it flies them out to one of its **super aircraft carriers**. Standing 20 stories above the water and stretching 1,092 feet (333 meters) from bow to stern (about as long as the 77-story Chrysler building is tall), the sheer bulk of these ships is awe-inspiring. But the really amazing thing about a supercarrier isn't its size; it's the intense scene on its flight deck. When the crew is in full swing, it can launch or land a plane every 25 seconds -- all in a fraction of the space available on a typical landing strip.

In this article, we'll find out what the U.S. Navy's modern Nimitz-class aircraft carriers are all about. We'll learn what's on the different decks, take a look at the amazing machines that help launch and land aircraft, and find out a little about daily life on these enormous floating bases. As we'll see, the modern aircraft carrier is one of the most amazing vehicles ever created.

What Aircraft Carriers Do

At its most basic level, an aircraft carrier is simply a ship outfitted with a **flight deck** -- a runway area for launching and landing airplanes. This concept dates back almost as far as airplanes themselves. Within 10 years of the Wright Brothers' historic 1903 flight, the United States, the United Kingdom and Germany were launching test flights from platforms attached to cruisers. The experiments proved largely successful, and the various naval forces started adapting existing warships for this purpose. The new carriers allowed military forces to transport short-range aircraft all over the world.

Carriers didn't play a huge role in World War I, but they were central to the air combat of World War II. For example, the Japanese launched the 1941 attack on Pearl Harbor from aircraft carriers. Today, **super aircraft carriers** are a crucial part of almost all major U.S. military operations. While the ship itself isn't especially useful as a weapon, the air power it transports can make the difference between victory and defeat.

One of the major obstacles of using air power in war is getting the planes to their destination. To maintain an air base in a foreign region, the United States (or any other nation) has to make special

arrangements with a host country, and then has to abide by that country's rules, which may change over time. Needless to say, this can be extremely difficult in some parts of the world.

Under international Freedom of Navigation laws, aircraft carriers and other warships are recognized as **sovereign territories** in almost all of the ocean. As long as a ship doesn't get too close to any nation's coast, the crew can carry on just like they're back home. So, while the U.S. military would have to make special arrangements with a foreign nation to set up a land military base, it can freely move a **carrier battle group** (an assembly of an aircraft carrier and six to eight other warships) all over the globe, just as if it were a little piece of the United States. Bombers, fighters and other aircraft can fly a variety of missions into enemy territory, and then return to the relatively safe home base of the carrier group. In most cases, the Navy can continually **replenish** (resupply) the carrier group, allowing it to maintain its position indefinitely.

Carriers can move in excess of 35 knots (40 mph, 64 kph), which gives them the ability to get anywhere in the ocean in a few weeks. The United States currently has six carrier groups stationed around the world, ready to move into action at a moment's notice.

Talking the Talk

Ships have their own special language, particularly when it comes to getting from point to point. Here's a quick primer, in case you don't know aft from bow.

- **Stern** - the rear of the ship
- **Bow** - the front of the ship
- **Starboard** - the right side of the ship (if you're facing the bow)
- **Port** - the left side of the ship
- **Forward** - moving toward the bow of the ship (as in, "Moving forward on the flight deck" or "The hangar deck is forward of the fantail.")
- **Aft** - moving toward the stern of the ship
- **Inboard** - moving from the side of the ship toward the center of the ship
- **Outboard** - moving from the center of the ship to the side of the ship
- **Below** - on a lower deck (as in, "Going below to the hangar" -- You never "go downstairs" on a ship, you always "go below.")
- **Fantail** - the stern area of the main deck (the hangar deck on a carrier)

Basic Structure

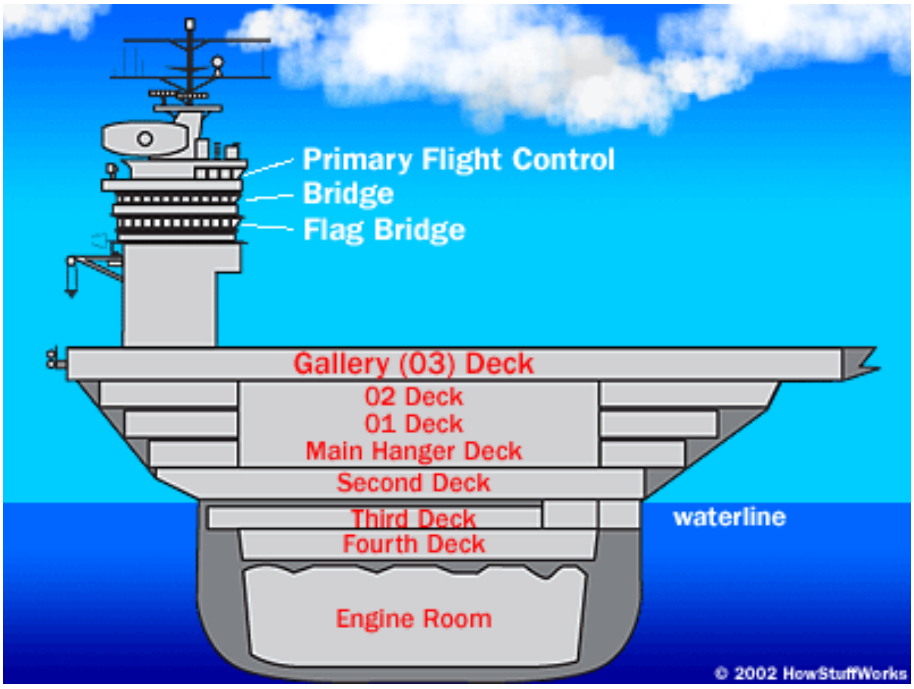
With about a billion individual pieces, the U.S. Nimitz-class supercarriers are among the most complex machines on earth. But on a conceptual level, they're pretty simple. They're designed to do four basic jobs:

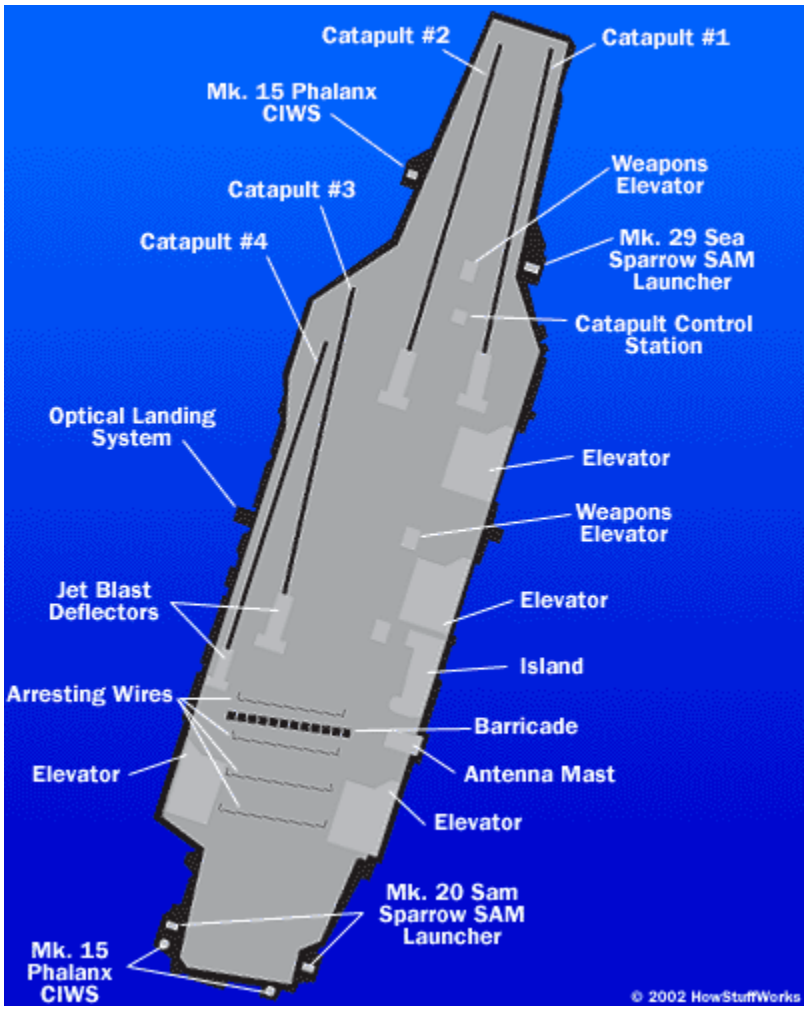
- Transport a variety of aircraft overseas
- Launch and land airplanes
- Serve as a mobile command center for military operations
- House all the people who do these things

To accomplish these tasks, a carrier needs to combine elements of a ship, an air force base, and a small city. Among other things, it needs:

- A **flight deck**, a flat surface on the top of the ship where aircraft can take off and land
- A **hangar deck**, an area below deck to stow aircraft when not in use
- An **island**, a building on top of the flight deck where officers can direct flight and ship operations
- Room for the crew to live and work
- A **power plant** and **propulsion system** to move the boat from point to point and to generate electricity for the entire ship
- Various other systems to provide food and fresh water and to handle things that any city has to deal with, like sewage, trash and mail, as well as carrier-based radio and television stations and newspapers
- The **hull**, the main body of the ship, which floats in water

The diagrams below show how these various components fit together.





The **hull** of the ship is made up of extremely strong steel plates, measuring several inches thick. This heavy body is highly effective protection against fire and battle damage. The ship's structural support largely comes from three horizontal structures extending across the entire hull: the keel (the iron backbone on the bottom of the ship), the flight deck and the hangar deck.

The hull portion below the water line is rounded and relatively narrow, while the section above water flares out to form the wide flight-deck space. The lower section of the ship has a **double bottom**, which is pretty much what it sounds like -- there are two layers of steel plating: the bottom plating of the ship and another layer above it, separated by a gap. The double bottom provides extra protection from torpedos or accidents at sea. If the enemy hits the bottom of the ship, smashing a hole in the outer steel layer, the second layer will prevent a massive leak.

Construction

Since the 1950s, almost all U.S. supercarriers have been constructed at Northrop Grumman Newport News in Newport News, Virginia. To make the construction process more efficient, most of each supercarrier is assembled in separate modular pieces called **superlifts**. Each superlift may contain many compartments (rooms), spanning multiple decks, and they can weigh anywhere from 80 to 900 tons (~70 to 800 metric tons). A supercarrier is made up of almost 200 separate superlifts.

Photo courtesy Northrop Grumman Newport News

Photo courtesy Northrop Grumman Newport News

The USS Ronald Reagan, under construction in the Northrop Grumman Newport News dry dock

Before placing a superlift module into the ship, the construction crew assembles its steel body and hooks up almost all wiring and plumbing. Then they use a giant **bridge crane** to lift the module and lower it precisely into its proper position inside the ship; then they weld it to the surrounding modules. Near the end of construction, the crew joins the last module, the 575-ton island, to the flight deck.

Photo courtesy U.S. Navy

Photo courtesy U.S. Navy
Lowering superlifts into position on the USS Harry S. Truman

Just like the family motor boat, an aircraft carrier propels itself through the water by spinning propellers. Of course, at about 21 feet (6.4 meters) across, a carrier's four bronze **screw propellers** are in a very different league than a recreational boat's. They also have a lot more power behind them. Each propeller is mounted to a long shaft, which is connected to a **steam turbine** powered by a **nuclear reactor**.

The carrier's two nuclear reactors, housed in a heavily-armored, heavily restricted area in the middle of the ship, generate loads of high-pressure steam to rotate fan blades inside the turbine. The fans turn the turbine shaft, which rotates the screw propellers to push the ship forward, while massive rudders steer the ship. The propulsion system boasts something in excess of 280,000 horsepower (the Navy doesn't release exact numbers).

The four onboard turbines also generate electricity to power the ship's various electric and electronic systems. This includes an onboard **desalination plant** that can turn 400,000 gallons (~1,500,000 liters) of saltwater into drinkable freshwater every day -- that's enough for 2,000 homes.

Unlike the old oil-boiler carriers, modern nuclear carriers don't have to refuel regularly. In fact, they can go 15 to 20 years without refueling. The trade-offs are a more expensive power plant, a longer, more complicated refueling process (it takes several years) and the added risk of a nuclear disaster at sea. To minimize the risk of such a catastrophe, the reactors inside a supercarrier are heavily shielded and closely monitored.

Big Numbers

These stats paint a nice picture of the scope of a Nimitz-class aircraft carrier.

From the USS Theodore Roosevelt Web site:

- Total height, from keel to mast - **244 feet** (~74 meters), as high as a 24 story building.
- Fully loaded displacement (the weight of water displaced by the ship when in full combat mode) - **97,000 tons** (~88,000 metric tons)
- Weight of structural steel - **60,000 tons** (~54,000 metric tons)
- Total area of flight deck - **4.5 acres** (~1.8 hectares)
- Length of flight deck - **1,092 feet** (~333 meters)
- Width of flight deck (at the widest point) - **257 feet** (~78 meters)
- Number of compartments and spaces onboard - **4,000+**
- Weight of each anchor - **30 tons** (~27 metric tons)
- Weight of each link in the anchor chains - **360 pounds** (~160 kg)
- Weight of each propeller - **66,200 pounds** (~30,000 kg)
- Weight of each rudder - **45.5 tons** (~41 metric tons)
- Storage capacity for aviation fuel - **3.3 million gallons** (~12.5 million liters)
- Number of telephones onboard - **2,500+**
- Number of televisions onboard - **3,000+**
- Total length of electrical cable onboard - **1,000+ miles** (1,600+ km)
- Air conditioning plant capacity - **2,250 tons** (~2,040 metric tons, enough to cool more than **500 houses**)

From the USS Nimitz Web site:

- Storage capacity for refrigerated and dried food: enough to feed **6,000 people** for **70 days**.
- Mail processed every year by onboard post office - **1 million pounds** (~450,000 kg)
- Number of dentists - **5**
- Number of medical doctors - **6**
- Beds in hospital ward - **53**
- Number of chaplains in interdenominational chapel - **3**
- Number of haircuts every week - **1,500+**
- Number of barbershops - **1**

Taking Off

An aircraft carrier flight deck is one of the most exhilarating and dangerous work environments in the world (not to mention one of the loudest). The deck may look like an ordinary land runway, but it works very differently, due to its smaller size. When the crew is in full swing, planes are landing and taking off at a furious rate in a limited space. One careless moment, and a fighter jet engine could suck somebody in or blast somebody off the edge of the deck into the ocean.

But as dangerous as the flight deck is for the deck crew, they have it pretty easy compared to the pilots. The flight deck isn't nearly long enough for most military planes to make ordinary landings or takeoffs, so they have to head out and come in with some extraordinary machine assistance.

Photo courtesy U.S Department of Defense
An A-6E Intruder launches from the USS George Washington.

If you've read How Airplanes Work, you know that an airplane has to get a lot of air moving over its wings to generate lift. To make takeoff a little easier, carriers can get additional airflow over the flight deck by speeding through the ocean, into the wind, in the direction of takeoff. This air moving over the wings lowers the plane's minimum takeoff speed.

Getting air moving over the deck is important, but the primary takeoff assistance comes from the carrier's four **catapults**, which get the planes up to high speeds in a very short distance. Each catapult consists of two pistons that sit inside two parallel cylinders, each about as long as a football field, positioned under the deck. The pistons each have a metal lug on their tip, which protrudes through a narrow gap along the top of each cylinder. The two lugs extend through rubber flanges, which seal the cylinders, and through a gap in the flight deck, where they attach to a small **shuttle**.

Photo courtesy U.S Department of Defense
The shuttle of catapult number four on USS John Stennis

To prepare for a takeoff, the flight deck crew moves the plane into position at the rear of the catapult and attaches the **towbar** on the plane's nose gear (front wheels) to a slot in the shuttle. The crew positions another bar, the **holdback**, between the back of the wheel and the shuttle (in F-14 and F/A-18 fighter jets, the holdback is built into the nose gear -- in other planes, it's a separate piece).

Photo courtesy U.S Navy

A member of the USS George Washington flight-deck crew checks an F-14 catapult attachments. Tomcat.

While all of this is going on, the flight crew raises the **jet blast deflector** (JBD) behind the plane (**aft** of the plane, in this case). When the JBD, towbar and holdback are all in position, and all the final checks have been made, the **catapult officer** (also known as the "shooter") gets the catapults ready from the **catapult control pod**, a small, encased control station with a transparent dome that protrudes above the flight deck.

Photo courtesy U.S Department of Defense

Steam rises from the catapult as an F/A-18C Hornet prepares to launch from the USS George

Washington. You can see the catapult officer in the catapult control pod.

Photo courtesy U.S Department of Defense

A F-14 Tomcat, positioned in front of the jet blast deflector on USS Nimitz's catapult #1

When the plane is ready to go, the catapult officer opens valves to fill the catapult cylinders with high-pressure steam from the ship's reactors. This steam provides the necessary force to propel the pistons at high speed, slinging the plane forward to generate the necessary lift for takeoff. Initially, the pistons are locked into place, so the cylinders simply build up pressure. The catapult officer carefully monitors the pressure level so it's just right for the particular plane and deck conditions. If the pressure is too low, the plane won't get moving fast enough to take off, and the catapult will throw it into the ocean. If there's too much pressure, the sudden jerk could break the nose gear right off.

When the cylinders are charged to the appropriate pressure level, the pilot blasts the plane's engines. The holdback keeps the plane on the shuttle while the engines generate considerable thrust. The catapult officer releases the pistons, the force causes the holdbacks to release, and the steam pressure slams the shuttle and plane forward. At the end of the catapult, the tow bar pops out of the shuttle, releasing the plane. This totally steam-driven system can rocket a 45,000-pound plane from 0 to 165 miles per hour in two seconds! (a 20,000-kg plane from 0 to 266 kph)

Photo courtesy U.S Department of Defense
An F/A-18 Hornet launching from the USS George Washington

If everything goes well, the speeding plane has generated enough lift to take off. If not, the pilot (or pilots) activate their ejector seats to escape before the plane goes hurdling into the ocean ahead of the ship (this hardly ever happens, but the risk is always there).

Taking off is extremely difficult, but the real trick is coming back in. In the next section, we'll take a look at the standard carrier landing, or **recovery**, procedure.

Landing

Landing on a flight deck is one of the most difficult things a navy pilot will ever do. The flight deck only has about 500 feet (~150 meters) of runway space for landing planes, which isn't nearly enough for the heavy, high-speed jets on U.S. carriers.

To land on the flight deck, each plane needs a **tailhook**, which is exactly what it sounds like -- an extended hook attached to the plane's tail. The pilot's goal is to snag the tailhook on one of four **arresting wires**, sturdy cables woven from high-tensile steel wire.

Photo courtesy U.S Department of Defense
An ES-3A Shadow comes in for a landing aboard the

USS George Washington.

The arresting wires are stretched across the deck and are attached on both ends to hydraulic cylinders below deck. If the tailhook snags an arresting wire, it pulls the wire out, and the hydraulic cylinder system absorbs the energy to bring the plane to a stop. The arresting wire system can stop a 54,000-pound aircraft travelling 150 miles per hour in only two seconds, in a 315-foot landing area (a 24,500-kg aircraft travelling at 241 kph in a 96-meter landing area).

Photo courtesy U.S Department of Defense

The tailhook of a KA-6D Intruder aircraft, about to catch an arresting wire on the USS Dwight D. Eisenhower

Photo courtesy U.S Department of Defense

An F/A-18C Hornet catches an arresting wire on the USS Nimitz.

There are four parallel arresting wires, spaced about 50 feet (15 meters) apart, to expand the target area for the pilot. Pilots are aiming for the **third wire**, as it's the safest and most effective target. They never shoot for the first wire because it's dangerously close to the edge of deck. If they come in too low on the first wire, they could easily crash into the stern of the ship. It's acceptable to snag the second or fourth wire, but for a pilot to move up through the ranks, he or she has to be able to catch the third wire consistently.

To pull off this incredible trick, the pilot needs to approach the deck at exactly the right angle. The landing procedure starts when the various returning planes "stack up" in a huge oval flying pattern near the carrier. The **Carrier Air Traffic Control Center** below deck decides the landing order of the waiting planes based on their various fuel levels (a plane that's about to run out of fuel comes down before one that can keep flying for a while). When it's time for a plane to land, the pilot breaks free of this landing pattern and heads toward the stern of the ship.

Landing Signals Officers (LSOs) help guide the plane in, through radio communication as well as a collection of lights on the deck. If the plane is coming in okay, the LSOs will illuminate green lights to tell the pilot everything is okay. If the plane is off course, the LSOs can illuminate other lights to correct him or her or "wave him off" (send him around for another attempt).

Photo courtesy U.S Department of Defense
The Landing Signals Officers guide a landing aircraft on the USS George Washington.

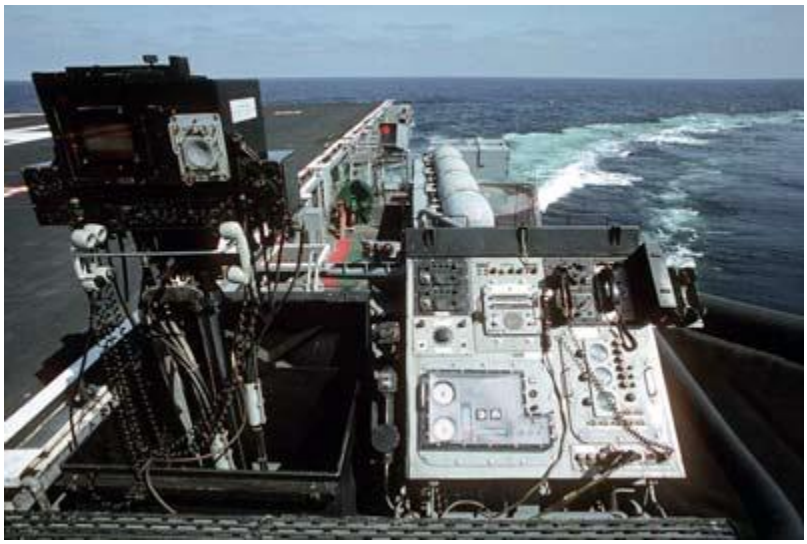


Photo courtesy U.S Department of Defense
The video display console and communications/data board at the Landing Signals Officers' work station

In addition to the LSOs, pilots look to the **Fresnel Lens Optical Landing System**, commonly referred to as **the lens**, for landing guidance. The lens consists of a series of lights and Fresnel lenses mounted to a gyroscopically stabilized platform. The lenses focus the light into narrow beams that are directed into the sky at various angles.

The pilot will see different lights depending on the plane's angle of approach. If the plane is right on target, the pilot will see an amber light, dubbed the "**meatball**," in line with a row of green lights. If the amber light appears above the green lights, the plane is coming in too high; if the amber light appears below the green lights, the plane is coming in too low. If the plane is coming in *way* too low, the pilot will see red lights.

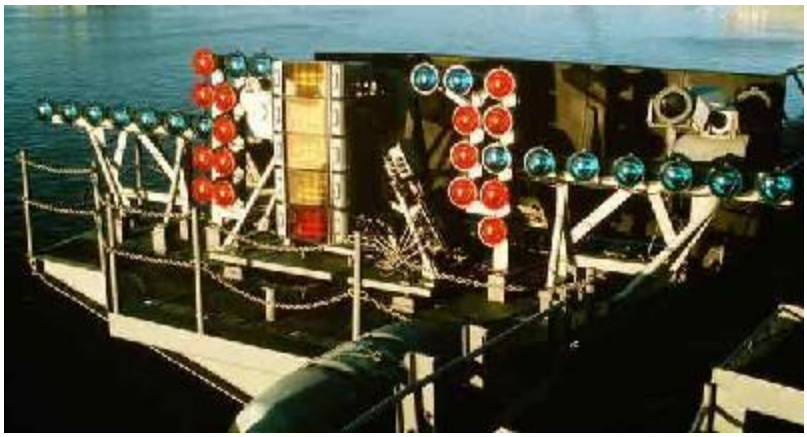


Photo courtesy U.S. Department of Defense
"The lens" on the USS John F. Kennedy

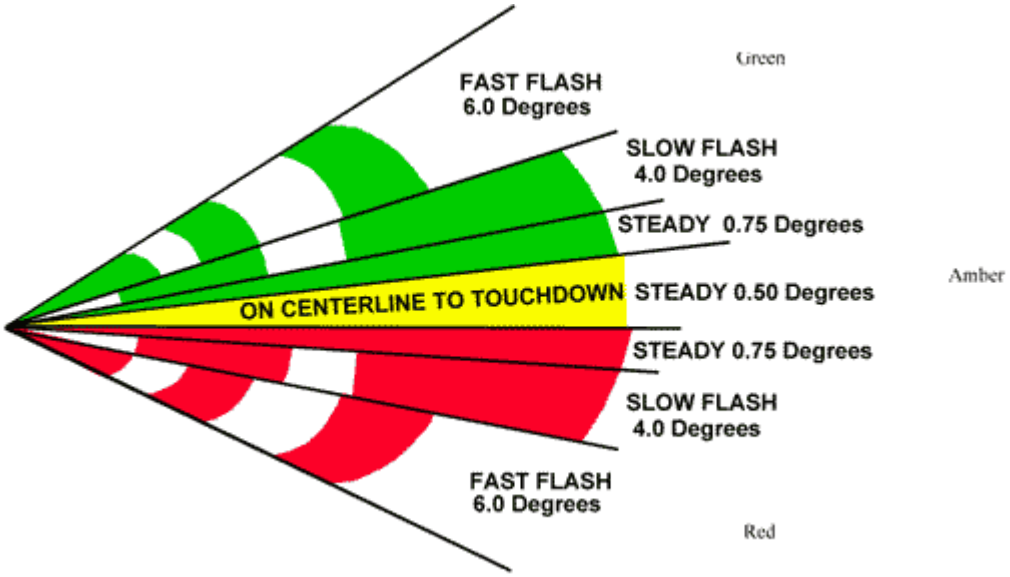


Photo courtesy U.S. Navy
A diagram illustrating the "Improved Fresnel Lens Optical Landing System."

As soon as the plane hits the deck, the pilot will push the engines to full power, instead of slowing down, to bring the plane to a stop. This may seem counterintuitive, but if the tailhook doesn't catch any of the arresting wires, the plane needs to be moving fast enough to take off again and come around for another pass. The landing runway is tilted at a 14-degree angle to the rest of the ship, so **bolters** like this can take off from the side of the ship instead of plowing into the planes on the other end of the deck.

As soon as an aircraft lands, it's pulled out of the landing strip and chained down on the side of the flight deck. Inactive aircraft are always tightly secured to keep them from sliding around as the deck rocks back and forth.

The flight-deck crew has to be prepared for a wide range of unexpected events, including raging aircraft fires. During takeoff or recovery operations, they have plenty of safety equipment at the ready. Among other things, the flight deck has a small fire truck, and nozzles leading to water tanks and **aqueous film-forming foam**, an advanced fire-extinguishing material (there are also nozzles for jet fuel and a number of other useful liquids).

Photo courtesy U.S Department of Defense

An S-3A Viking aircraft lands on the USS Abraham Lincoln with the help of the crash barricade. The plane had to make an unconventional landing due to a problem with its landing gear.

Flight-deck personnel also face the risk of a jet engine blowing them overboard. Safety nets around the side of the flight deck offer some protection, but for extra safety, personnel are also equipped with **float coats**, self-inflating jackets with flashing distress lights, activated by contact with water. Flight-deck personnel also wear heavy-duty helmets, called **cranials**, which protect their head and their hearing.

Onboard Weaponry

A carrier's real muscle is its aircraft squadron, but it has a number of built-in weapons, as well, to take down any enemy aircraft or missiles attacking the ship. A modern U.S. supercarrier has three Mk. 29 Sea Sparrow eight-round missile launchers and two Mk. 15 Phalanx Close-In Weapons System (CIWS) 20-mm Gatling guns spaced around the flight deck, and an additional Mk. 15 on the fantail. The surface-to-air missiles use a radar-seeker to home in on signals (from the carrier's radar system) reflecting off the target.

U.S. supercarriers also have a number of defensive systems. In the event of a submarine attack, a carrier will launch two SLQ-25A "Nixies," noise-making decoy targets that drag behind the ship to attract torpedos.

The Island

An aircraft carrier's "island" is the command center for flight-deck operations, as well as the ship as a whole. The island is about 150 feet (46 m) tall, but it's only 20 feet (6 m) wide at the base, so it won't take up too much space on the flight deck. The top of the island, well above the height of any aircraft on the flight deck, is spread out to provide more room.

Photo courtesy U.S Department of Defense
The island on the USS Abraham Lincoln

The top of the island is outfitted with an array of radar and communications antennas, which keep tabs on surrounding ships and aircraft, intercept and jam enemy radar signals, target enemy aircraft and missiles and pick up satellite phone and TV signals, among other things. Below that is the **Primary Flight Control**, or **Pri-Fly**. In the Pri-Fly, the **air officer** and **air officer assistant** (known as the "Air Boss" and the "Mini Boss") direct all aircraft activity on the flight deck and within a 5-mile (8-km) radius.

Photo courtesy U.S Department of Defense
The busy scene in the Pri-Fly

The Air Boss and Mini-Boss, both experienced aviators, have an array of computers and communications equipment to keep tabs on everything, but they get a lot of information just by looking out their windows, six stories above the flight deck. When an approaching plane gets within three-quarters of a mile (1.2 km), the Landing Signals Officers take over control to direct the landing procedure. At the same level as the Pri-Fly, crew and visitors can walk out onto **vulture's row**, a balcony platform with a great view of the entire flight deck.

The next level down is **the bridge**, the ship's command center. The commanding officer (the captain) usually **cons** (controls) this ship from a stately leather chair surrounded by computer screens. The

commanding officer directs the **helmsman**, who actually steers the carrier, the **lee helmsman**, who directs the engine room to control the speed of the ship, the **Quartermaster of the Watch**, who keeps track of navigation information, and a number of lookouts and support personnel. When the commanding officer is not on the bridge, he puts an Officer of the Deck in charge of operations.

Photo courtesy U.S Department of Defense
Captain David Logsdon commands the USS Harry Truman from the flight deck.

Photo courtesy U.S Department of Defense
The lee helmsman (left) and helmsman on the USS Theodore Roosevelt

Interestingly enough, many carrier commanding officers are former Navy airplane pilots, so they have a personal understanding of flight-deck operations. As long as they're in command of a carrier, however, they're prohibited from climbing into the cockpit to fly a plane themselves.

Just like the Pri-Fly, the bridge is outfitted with an array of high-end monitors, including GPS receivers and many radar screens. But the commanding officer and his team still rely heavily on their own eyes to keep tabs on activity around the ship.

The level below the bridge is the **flag bridge**, the command center for the **admiral** in charge of the entire carrier group. Below that, there are various operational centers, including the **flight deck control and launch operations room**. In this tight, windowless space, the **aircraft handling officer** (also called the **handler** or **mangler**) and his or her crew keep track of all the aircraft on the flight deck and in the hangar. The handler's primary tracking tool is the "Ouija Board," a two-level transparent plastic table with etched outlines of the flight deck and hangar deck. Each aircraft is represented by a scale aircraft cut-out on the table. When a real plane moves from point to point, the handler moves the model plane accordingly. When the plane is out of service, because it needs repair work, the handler turns it over.

Photo courtesy U.S Department of Defense
Crew members on the USS George Washington circle around the "Ouija Board."

There are a number of additional control centers below deck, including the **carrier air traffic control center** (CATCC), which takes up several rooms on the **galley deck** (immediately below the flight deck). Like a land-based air traffic control center, the CATCC is filled with all sorts of radio and radar equipment, which the controllers use to keep track of aircraft in the area (in this case, mainly the aircraft outside the Air Boss's supervision).

The CATCC is next to the **combat direction center** (CDC), the ship's battle command center. The CDC's primary responsibility is to process incoming information on enemy threats in order to keep the commanding officer fully informed.

Photo courtesy U.S Department of Defense
An air traffic controller onboard the USS Kitty Hawk

Photo courtesy U.S Department of Defense
An antisubmarine warfare specialist on the USS Carl Vinson monitors activities in the Persian Gulf.

The Hangar

The flight-deck crew can keep a small number of aircraft up top, but there's not nearly enough room for the 80 to 100 aircraft stationed on a typical carrier. When they're not in use, most of the aircraft are secured in the **hangar bay**, the "carrier's garage."

The hangar bay is located two decks below the flight deck, just below the galley deck. The bay itself is 110 feet (~34 m) wide, 25 feet (~8 m) high and 685 feet (~209 m) long -- more than two-thirds the length of the entire ship. It can hold more than 60 aircraft, as well as spare jet engines, fuel tanks and other heavy equipment, in four **zones** divided by sliding doors (a safety precaution to stop a fire from spreading).

Photo courtesy U.S. Department of Defense
The hangar deck on the USS Dwight D. Eisenhower

The hangar is three decks high, and it's flanked by various single-deck compartments on both sides. There are also four giant elevators surrounding the hangar, which move the aircraft from the hangar to the flight deck. The high-speed, aluminum hydraulic elevators are big enough and powerful enough to lift two 74,000-pound (~34,000-kg) fighter jets.

Photo courtesy U.S Navy
One of the hydraulic elevators on the USS George Washington, lowered to the hangar deck

Aft of the hangar bay, in the stern of the ship, you'll find the **Aircraft Intermediate Maintenance Division** (AIMD) shops. The men and women in these shops are constantly repairing and testing aircraft equipment to keep the flight squadron at full force. At the very end of the ship, the AIMD shops lead to an open-air **engine testing area** on the ship's fantail. This is the only place on the ship where the maintenance crews can safely blast aircraft jet engines to make sure they're working properly.

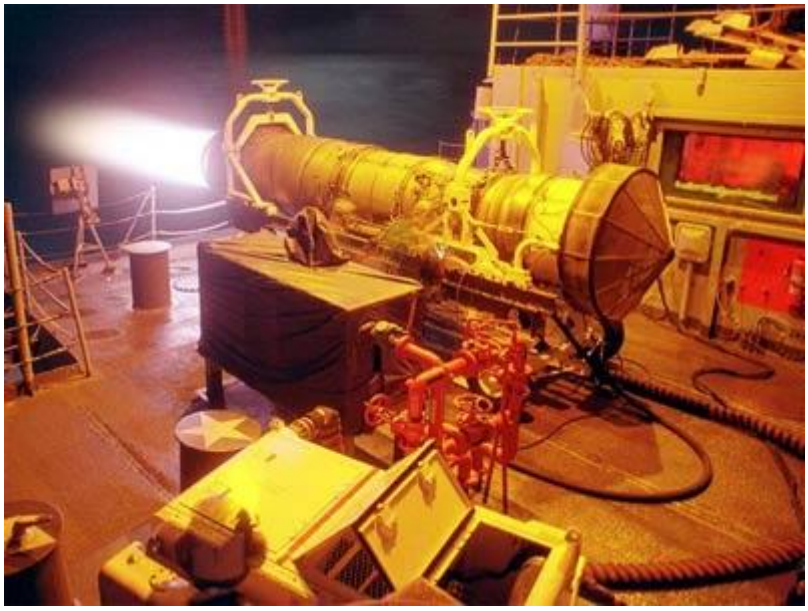


Photo courtesy U.S. Navy
Testing an F-14 engine on the fantail of the USS Kitty Hawk

What's Onboard?

A major part of every aircraft carrier, logically, is the aircraft onboard. Carriers transport dozens of different aircraft specially designed to withstand the constant abuse of catapult takeoffs and arresting-wire landings. A carrier **air wing** typically consists of nine squadrons, with 70 to 80 total aircraft. The more notable onboard aircraft include:

- The F/A-18 Hornet - a single-seat strike fighter jet designed to take out enemy aircraft as well as ground targets
- The F-14 Tomcat - a two-seat fighter jet optimized for air superiority (A carrier's F-14 squadron is a crucial weapon in protecting the carrier battle group.)
- The E-2C Hawkeye - a tactical warning and control system aircraft (The aircraft's advanced radar system lets the air wing keep the fighter jets updated on enemy activity.)
- The S-3B Viking - a subsonic jet aircraft primarily used to take out enemy submarines
- The EA-6B Prowler - an electronic warfare aircraft (The Prowler's mission is to jam enemy radar and intercept enemy communications.)
- The SH-60 Seahawk - a twin-engine helicopter primarily used to attack enemy submarines and in search-and-rescue operations

Life Onboard

The modern supercarrier is widely referred to as a "city at sea." With between 5,000 and 6,000 people working, relaxing, eating and sleeping onboard for months at a time, this is certainly accurate. But it's not at all like any city you would find on dry land.

Photo courtesy U.S Department of Defense
Members of the USS George Washington crew scrub the flight deck.

For starters, most residents have little opportunity to see the outside world. The flight deck, hangar and fantail all have wonderful views of the sea and sky, but they are so hectic and dangerous that only a handful of people are allowed access during normal operations. The top levels of the island are safe enough, but sensitive operations and limited space means you can't have a lot of people coming and going. A sailor who works below deck might go weeks and weeks without ever seeing daylight.

Throughout the ship, conditions are much more cramped than in a normal city. To get from place to place, personnel have to scale nearly vertical steps and squeeze past each other in narrow corridors. The **berthing** compartments (sleeping quarters) are extremely tight. Enlisted personnel share a compartment with about 60 other people, all sleeping in single bunks, generally called **racks**, crammed together in stacks of three. Each person gets a small stowage bin and upright locker for clothes and personal belongings, and everybody in the compartment shares a bathroom and a small common area with a television hooked up to one of the carrier's satellite dishes. Officers enjoy more space and finer furnishings, but their space is limited, too. Everybody onboard has to get used to tight quarters.

Photo courtesy U.S Department of Defense
Firing practice onboard the USS Independence

Photo courtesy U.S. Navy
2001 New Year's Eve party in the USS Theodore Roosevelt hangar bay

Jobs are highly varied, just like in a normal city. Approximately 2,500 men and women form the **air wing**, the people who actually fly and maintain the aircraft. Another 3,000 or so people make up the **ship's company**, which keeps all parts of the carrier running smoothly -- this includes everything from washing dishes and preparing meals to handling weaponry and maintaining the nuclear reactors.

The ship has everything its residents need to live, even if it's not as comfortably as they would like. There are multiple **galleys** (kitchens) and **mess halls** onboard, which collectively serve as many as 18,000 meals a day. The ship also has a sizable laundry facility, dentist and doctor's offices, various stores and a bank of telephones where personnel can talk to their families via satellite.

Photo courtesy U.S. Navy
Sailors phoning home onboard the USS Harry S. Truman

Life onboard an aircraft carrier is undeniably difficult and exhausting, but it can also be exhilarating, especially for the men and women up on the flight deck, flying and bringing in planes on a tiny patch of runway. Good or bad, it's like no other place on earth.

For more information about aircraft carriers, including their fascinating history and possible future, check out the links on the next page.

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