FIREROOM and BOILERS

Engineering Department

On an aircraft carrier, there are typically up to 530 enlisted personnel in the engineering department

Staff Needed to Man Fireroom and Boilers--

--Fireroom--3 to 4 men depending on how many boilers were online

--Dual boiler— 6 to 8 men depending if the remote water indicators were working properly

Fireroom Temperature was around 125 degrees and very humid that's why the shifts were only four hours long.

Noise in the fireroom was extreme and no ear protection was worn.

Firebox is the size of a small bedroom and the boiler is the size of a small house

Boilers are Babcock Wilcox M-Type boilers and have 5,000 tubes each.

The entire process of burning oil was to make fire to make steam.

The fire heats the boiler above it to create two kinds of steam—the first steam was a wet steam (250 degrees) is used for cooking and heating, and the second steam is heated again to get super-heated steam (850 degrees) which is a very dry steam used to turn the turbines that turn the double reduction gears that eventually turn the propellers that make the ship go up to 32 nautical miles.

Bunker Oil

--The Hornet's held up to 1,800,000 gals of bunker oil.

--We still have about 100,000 gals still in those tanks.

-- Bunker oil could be loaded directly into the fuel tanks, but heaters had to be started even in warm waters.

Bunker C was used to make fire that heated the water that made steam that heated food and water for cooking and washing, and steam also ran generators that made electricity to keep the lights on and to keep other electrical things going.

The bunker oil is very thick and sticky, so it needed to be heated to at least 150 degrees to pump out of the tank storage (along the sides of the ship).

When it was time to use it, the Bunker C was piped through the fuel heater and comes out at approximately 170-200 degrees.

The hot oil is then pushed at 150 PSI for standard speed (11.5-12.5 knots) and at 300 PSI for flank speed (31.5-32 knots)

Amount of oil used at different speeds

Standard speed was 11.5-12.5 knots (14.38 MPH)

Flank speed is all out at 31.5-32 knots (37 MPH)

Steaming for 24 hours at standard speed burned 140,000 to 150,000 gallons of oil per day

--6,135 gals/hour and equal to about 218 gallons/min

--That's 8% of the total fuel capacity of 1,800,000 gallons.

Running at flank speed used 13,250 gallons per hour or 300,000 gallons per day

--Hornet rarely ran at flank speed for very long because it put a lot of stress on the propeller shafts

--2 shafts are 258 feet long

--2 shafts are 160 feet long

--20" diameter shafts

--Each propeller is 15 feet diameter weighing 27,000 pounds

--Target speed for launching airplanes was 35 knots of wind over the deck which includes the natural wind blowing

Making Steam

How much water did the ship need?

The ship as a whole needed around 100,000 gallons per day of purified water to function properly and 2/3 of that was used for ship propulsion only.

50,000 to 55,000 gallons of fresh water was lost every day in the propulsion plant (main user) and other daily consumption, as well as water lost by evaporation and valve leaks.

The water used needed to be especially free from contaminates—10 PPM made by the water evaporator was the ideal purity for boiler water.

Boiler water was regularly analyzed for Ph7 and Chlorides (salt)—

--Phosphates were used to treat boiler water to maintain Ph7

Water and Steam Pressure levels

Water Level Indicator—

--Check Man or First Check Man watched the water level and pressure

--The water level was to remain at halfway on the gauge, then when it's there, they went from manual control to auto control.

Bilge Pumps

When you are working with water/steam, there will always be leaks and accumulate water needed to be pumped out.

Bilge pumps in the fireroom are under the metal door and about 17 feet below the waterline.

Burner Tubes & Face Plates

When the oil is hot enough, it's then directed to the six burner fuel lines and also to the five burner fuel lines of the super heater (It's the same with each boiler) to **spray out of the end of the burner tubes (oil injector)** into the firebox clockwise.

The orifice plates are at the end of each tube and has six different size holes to control the amount of oil that flows at a given pressure—from pin hole to larger

--Small one allows less oil in for slower speeds (standard 150 PSI)

--Larger ones allow more oil to spray for faster speeds (flank 300 PSI)

--Time it took to go step by step from standard speed to flank speed took about 45 minutes—

--Had to do it in steps—standard to full, full to flank

--Must stabilize power at each step

--Change burner tubes at each step

--When stopping, it was the same thing but in reverse

--Process covers about 3.5 miles of open-ocean to complete

Main Oil Pressure Control Valve red handled lever would be pointed mid-scale at standard speed (140-150 PSI), and all the way clockwise for flank speed (300 PSI)

To turn oil flow up or down at each burner plate, there's a valve to left of the burner plate.

Cleaning Injector Tubes and Plates

Bunker oil is very dirty and sticky, so the burner tubes (oil injector) needed to be cleaned every four hours—

--Take each one out every 4 hours and replace it with a clean one.

--Shut off the oil valve for each burner one at a time, open the cap, loosen the screw holding the burner plate face in place and replace it with a clean one.

--The crew had to have clean replacements ready for the next shift crew.

Air Needed to Make Fire

Air is allowed in to the furnace by opening the burner flappers, and the finned ring causes the air to blow in counter clockwise to properly and completely mix the oil and air to get the biggest and best results.

Air control is on the burner front and they could lift the burner cover to see inside, and there's a little window at the front of the furnace to allow the sailors to look inside the firebox to see if there's fire going.

Once they got the oil and air both spraying in to the firebox, it was time to light that sucker up with a torch dipped in kerosene then put through the hole to create an explosion of a 6-8 foot FIREBALL was the ideal boiler flame!

Type of Smoke

The air to oil ratio is a very important--

--Black smoke -- too little air and causes incomplete combustion is especially bad during combat conditions because it can be seen from a long distance away making the ship easy to spot by the enemy.

--Heavy white smoke -- too much air causes there was not enough oil being burned to run the ship at optimal propulsion and it's also easy to spot by the enemy.

--Light greyish-brown haze like smog -- the perfect smoke meaning it's the ideal mix of air to oil and also it is barely visible coming off of the stack.

How did they see it the smoke?

-They looked through the telescopes (periscope) on the lower level of each boiler which allowed the chief boilerman to look at the smoke conditions inside the furnace where the exhaust gasses are building up to exit to the uptakes.

Cleaning Fireboxes

Bunker oil is very dirty and leaves a lot of residue, and the fire was so constant and hot within the fireboxes that it slowly disintegrated the brick lining inside, so they **had to shut down the boilers every 600-800 hours (25-30 days)** to clean the fireboxes.

--They removed the access plates so the smallest guy could get inside with steel rakes, brushes and dust pans to scrape out all the carbon deposits and it was MESSY!

Soot Blowers

Because of all the bunker oil soot residue buildup, they needed blow the soot once daily when permission was given by the bridge to blow tubes--

--Ship must first be sailed in such a direction that the wind is blowing the dirty soot AWAY from the flight deck and the airplanes **or there will be HECK TO PAY from the Captain** and the crew that needed to clean it all off.

--Tubes are blown sequentially starting with the economizer tubes then the rest of the tubes from the bottom up.

--The process is complete with a second blowing of the economizer tubes.

Making Electricity

Fireroom three and four have the Ship's Service Turbo Generators (SSTG) to make and distribute electricity throughout the ship and controlled at the distribution switchboard in the space.