Fleet Oiler Design
Excerpts from "Gray Steel and Black Oil"

The 1952 Conference on Mobile Logistic Support

Committee No.2 was charged with evaluating matters pertaining to AOs, AORs, AEs, and CVs. Although the navy had more than enough T3-type tankers to meet its needs for the foreseeable future, it was clear that these ships lacked the speed, cargo capacity, and transfer rates needed to satisfy the demanding logistic requirements of modern air warfare as conducted by the Essex-class carriers on Task Force 77 during the conflict in Korea. No longer hampered by a lack of funds, the navy resurrected plans to build a new fleet oiler—the first to be designed from the keel up since the *Kanawha* was laid down in 1913.

General Characteristics of the AO-143 Class (as PROPOSED)
A report from Committee No.2

Characteristics:		
Displacement		36,000 tons
Length		655 feet
Speed fully loaded		20 knots
Replenishment speed		17 knots
Can transfer simultaneously:		
720,000 gph-Black		
200,000 gph-Avgas		
180,000 gph-HEAF		
120,000 GPH Diesel		
Fueling Stations:	8	
Replenishment stations:	2 midship	
Fueling at sea cranes being considered		
Typical [CV] replenishment would use:		
2-7" hoses--Black		360,000 gph
1-7" hose –HEAF		180,000 gph
1-6" hose –Avgas		100,000 gph

ComServPac was convinced that the optimum performance from issuing ships could only be attained from ships designed from the keel up. So important were the principles of underway replenishment to the concept of "all oceans" naval operations "that ComServPac adopted the same care and attention in their design as was then accepted as a matter of course in the case of combatant types."

The Neosho Class AO-143

The *Neosho* and the five others of her class that followed were the first oilers in the U.S. Navy to be engineered specifically for underway replenishment. They were basically similar in design to the older *Cimarron* class except that they were larger and faster. They carried one-third more cargo. Unlike the Cimarron, which had been modified after construction to handle gasoline, the cargo tank arrangement of the new ships were designed expressly to meet the particular needs of this liquid. Since it was desirable to put saltwater ballast in the tanks normally used to carry gasoline, a design was devised that placed the tanks on the centerline amidships so that ballasting was not required of these compartments. A cofferdam was constructed around the gasoline tanks to prevent contamination and the gasoline tanks were surrounded by black oil and diesel tanks to afford some protection to the highly volatile gasoline.

In recognition of the need to handle non-liquid cargo, the cargo deck (01 deck) on the new oilers extended from the forecastle to the poop the full beam of the ship and was equipped with two midship transfer stations for moving dry cargo by Burtoning (yard and stay) or highline. The cargo deck, which had a clear fore-and-aft passage to facilitate movement of cargo, also provided support for the eight fueling rigs designed dispense liquid fuels through a newly developed 7-inch

lightweight hose. Extra stowage space was provided below decks for additional provisions that could be issued to ships alongside on an emergency basis.

Improvements to the Fueling Rig

Fueling Rig improvements were not included in the AO-143 design. A separate research project was established within Bureau of Ships (BuShips) to develop a fueling rig that could be used in extremely heavy weather. Working with the Otis Elevator Company, the project officer came up a counterweight system for tensioning the span wire, which allowed the fueling ships to be separated by as much as 300 feet. The unique feature of this system was a lead counterweight that moved up and down inside the kingpost. A prototype was installed in the Pawcatuck (AO-108) and tested in 1954. The test was a success which led to its installation as a "Ram Tension Span Wire" in all fleet oilers commencing in 1956.

The Second Conference on Mobile Logistic Support

Another step in improving replenishment at sea was to combine the supplies of other type ships into one ship to cut down on alongside time. (*All time spent in replenishment was time lost in combat)* A larger ship was needed also to improve severe weather problems where the AO-22 class and AO-143 class yawed so bad that holding station was impossible. Looking at the sea keeping capabilities of the *Iowa*-class battleships, a new AOE type ship was specified to 795 feet in length with a beam of 107 feet and a full-load displacement of 53,600 tons. The hull was modeled after that used for the North Carolina-class battleships with particular attentions paid to those ship-control features that would enhance its maneuvering capabilities during underway replenishment. The first new ship completed was *Sacramento (AOE-1).* She had engines almost four times as great as AO-143 class which were salvaged from the battleship Kentucky which had been canceled before completion.

Ship-to-Ship Probe Fueling

The development of the 7-inch, lightweight collapsible hose, was only one problem associated with refueling at sea. It was derived from a British design to replace the rigid, wire-reinforced hose that had been introduced in the Second World War.

Restrictions imposed by the end couplings and the time needed to rig and unrig them continued to the ongoing hazards and the relatively large number of people needed to man a fueling station. BuShips launched, about 1957, a program to develop a "probe" fueling device, having as its basis the techniques used by aircraft during in-flight refueling. In 1965 a final form was approved consisting of a male fitting attached to the terminal end of a 7-inch hose "flown" by the oiler. The fitting rides the span wire on a trolley, and mates with a swivel elbow on the receiving ship. Upon mating, the female fitting is sealed in the receiver and a poppet valve opens to permit the flow of fuel. The poppet valve prevents leakage of fuel when, at breakaway, the probe disconnects from the receiver.

This improvement reduced the manning requirements at each fueling station from six to two men, permitting fueling to be accomplished in bad weather without the need to wrestle with riding lines or line up of recalcitrant couplings. and decreased the connection time to as little as three minutes from messenger passing to pumping – a 300 percent improvement over other rigs. See Probe and methods on page 141

Jumboization

As AOEs were added to the fleet, it would no longer be necessary for fleet oilers to keep up with a battle group; instead they could be kept out of harm's way shuttling back and forth between the sources of supply and the fast combat-support ships at sea. Except for the relatively new *Neosho* class oilers, no other fleet oiler had a cargo capacity large enough to fill an empty AOE. In lieu of new construction, the navy decided to enlarge and extend the service life of several T3 tankers. The conversion life was short due to a period of austerity.

Jumboization was accomplished where ships were moved by tugs in into a floating dry dock. Cutting torches neatly sliced the ships in two just aft of the bow and the aft section floated away. A new midbody was floated in, properly positioned and welded to the old bow. Next, the 190 ton superstructure amidships was lifted from the old midbody to the new section. The original section was then cut from the old midbody and floated away. In the final step of the transformation, the new midbody with old bow and superstructure now attached was floated into the dry dock, raised and welded to the old stern. Modifications, including a new counterbalanced rudder, new struts and shorter propeller shafts, were made in the stern to compensate for the longer underwater body.

The latest in fueling and replenishment-at-sea equipment was installed to complete the conversion. These included kingposts with outriggers, ram-tensioned span wires and high-lines, heavy-weather rigs with up to three hundred feet for either hose or wire at each station, electric-hydraulic winches in place of the old steam winches, and a helicopter platform on the forward weather deck. Each fueling station was equipped with new 7-inch lightweight hose and the pumping capacity was improved by installing larger cargo pumps and piping.

These words were taken, by permission, from the book “Gray Steel and Black Oil, Fast Tankers and Replenishment at Sea in the U.S. Navy, 1912-1992”. It was published by Naval Institute Press, Annapolis Maryland At this writing the book is out of print but can be viewed at the Library of Congress.