NATIONAL REGISTER ELIGIBILITY ASSESSMENT
VESSEL: *Sagamore*

The coastal tanker *Sagamore* moored at the Suisun Bay Reserve Fleet in Benicia, California in February 2009. Maritime Administration photograph.

Vessel History

The coastal liquid-bulk tanker *Alaska Standard* (later renamed *Sagamore*), was launched in 1959 by Albina Engine and Machine Works of Portland, Oregon, originally founded in 1904 as a repair yard, for the Standard Oil Company of California. L. C. Norgaard & Associates of San Francisco designed the ship. Its sponsor was Neva Egan, wife of the first governor of Alaska, William A. Egan who also attended the launching ceremony. The ship was constructed to continue the duties of its predecessor, the first *Alaska Standard,* which was built in 1923. For 35 years the earlier vessel supplied fuel to extremely remote towns and villages located along Alaska's rugged coast, as well as to the camps of miners, trappers, and fishermen.

Albina Engine and Machine Works later specialized in the construction of small vessels, tugs, barges, fireboats, lighthouse tenders, and buoy tenders. The company built small naval vessels for both world wars, and had begun a series of 181-foot cargo vessels for the Army Transportation Corps but the order was cancelled when World War II ended. They were, however, able to complete 20 of these ships, all of which operated under the Dutch flag in the East Indies.

The second *Alaska Standard* was delivered to its owner on April 1, 1959 and began operations that year. The most exciting event in the ship's history occurred on March 27, 1964 when a massive earthquake (which later became known as the "Good Friday" or "Great Alaska Earthquake") rocked south-central Alaska and was soon followed by a tsunami. The quake was originally rated at 8.6 on the Richter Scale, but was later upgraded to 9.2, making it the most powerful earthquake ever recorded in North America. The damage was extensive, but because the area was sparsely populated, the death toll was just 131, of which 119 were killed by the tsunami.

When the earthquake struck, the *Alaska Standard* was docked at a wharf in the port of Seward (about 127 miles southeast of Anchorage), with seven mooring lines out, transferring gasoline through five hoses. AB (Able Seaman) Ted Pederson was ashore checking the valves on the fuel lines. When Pederson felt the wharf shaking, he dashed toward his ship. The earth's violent movement lifted the wharf about 10 feet up into the air and just as quickly, brought it crashing down. Simultaneously, the water from the bay began to empty. One observer on shore said the ship completely disappeared from view. Pedersen was swept up into a debris-filled wave, and as the mooring lines and hoses parted, the gasoline burst into flames and the wharf and a large section of the shoreline collapsed into the bay. Miraculously, Pederson was swept onto the ship where he later regained consciousness, suffering from just a broken leg.

Captain Harold Solibakke got the ship underway and safely out of the fire and a succession of tsunami-like waves, the largest of which swept completely over the remaining port area driving a ball of flames into the town. The tanker probably owed its survival to the quick response of its diesel engine. Once the *Alaska Standard* was clear of the fire, its radio operator transmitted a report on the situation in Seward with a request that Coast Guard cutters and other vessels come to the aid of the town. He also reported that the town of Valdez had been largely destroyed. The following day, with Coast Guard vessels arriving, the *Alaska Standard* proceeded on its scheduled voyage to Cordova and Ketchikan.

After the drama of the earthquake and its aftermath subsided, the *Alaska Standard* settled back into its routine coastwise trade, and continued in that trade for some 20 more years. It was removed from service and laid-up in Seattle, Washington in June 1985.[1] The reasons for its removal were not documented; however, it was apparent that the vessel had suffered a mechanical incident that affected the alignment of its propeller shaft, and reduced its effective speed to about 10 knots. The year 1984 saw the merger of the vessel's owner, the Standard Oil Company of California, and the Gulf Oil Company to create Chevron, although Maritime Administration (MARAD) files record the vessel's sale to "Chevron U.S.A. Inc.," on January 3, 1977.

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[1] Maritime Administration Ship Survey Report, prepared by Henry D. Ryan, Marine Surveyor. Date of survey, December 3, 1986. The report notes the date of vessel lay-up.

Maritime Administration

Other MARAD records related to the acquisition of the *Sagamore* establish that the vessel was sold by Chevron to Sealift Tankships, Inc., of Dover, Delaware on August 26, 1986, and that this was the effective date of the name change from *Alaska Standard* to *Sagamore*. Sealift subsequently offered the vessel to MARAD under the provisions of the Ship Exchange Program[2] for the purpose of upgrading the inventory of the National Defense Reserve Fleet (NDRF). After a joint review with the U.S. Navy, MARAD determined that the *Sagamore* was a suitable exchange candidate and accepted the offer from Sealift. The obsolete vessels *Rawlins*, *Victoria* and *J.C. Breckenridge* were sold for scrap on August 18, 1987, with the sale proceeds being applied to the acquisition of the *Sagamore* ($350,000 on August 31, 1987) and the oceangoing tanker *Texaco Maryland*.

In September 1987 the *Sagamore* was assigned to American President Lines (APL) of San Francisco, acting as General Agent for MARAD, for the purpose of towing the vessel from Seattle and preparing it for lay-up in MARAD's National NDRF at Suisun Bay in Benicia, California. APL commenced the work immediately, and *Sagamore* was delivered to the Suisun Bay Reserve Fleet (SBRF) on October 20, 1987.

The NDRF was established under Section XI of the Merchant Ship Sales Act of 1946 to serve as a reserve of ships for national defense and national emergencies. A Ready Reserve Fleet (RFF) component was established in 1976. RRF vessels can be activated on short notice to provide rapid deployment of military equipment during an emergency. When activated, operational control of the ships is transferred from MARAD to the Navy's MSC. The RRF later became known as the Ready Reserve Force.

Prior to RRF operations, NDRF vessels supported emergency shipping requirements in seven wars and crises. During the Korean War, 540 vessels were activated to support military forces. A worldwide tonnage shortfall from 1951 to 1953 required over 600 ship activations to lift coal to Northern Europe and grain to India. Another tonnage shortfall following the Suez Canal closing in 1956 activated 223 cargo ships and 29 tankers from the NDRF. From 1955 through 1964, another 698 ships stored grain for the U.S. Department of Agriculture. During the Berlin crisis of 1961, 18 vessels were activated and remained in service until 1970. During the Vietnam War 172 vessels were activated. In August 1990, the RRF consisted of 96 ships, 78 of which were activated to support Operations DESERT SHIELD/DESERT STORM. This was the first large-scale activation and employment of the RRF since it was separated from the NDRF. The vessels involved were roll-on/roll-off (Ro-Ro) vessels (which describe how cargo is handled), break-bulk cargo ships, tankers, and barge carriers.

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[2] Better known as the "510(i)" program, referring to the section of the Merchant Marine Act of 1936, as amended, that authorized MARAD to "trade out" obsolete vessels in the NDRF in exchange for more modern and "suitable" vessels to be "traded in" for future government use. In practice, MARAD identified and scrapped a number of obsolete vessels whose total recoverable metal weight (lightship tonnage) equaled or exceeded the lightship tonnage of the vessel(s) being offered for trade-in. The proceeds of the scrap sale were used to purchase the vessel(s) being traded in.

Sagamore was acquired with the intention of upgrading it into the RRF. At that time, the RRF was programmed for expansion to an eventual total of 142 vessels, of which at least 40 were to be product tankers of various sizes. Funds were not available to complete the upgrade, however, in the aftermath of the first Gulf War, expansion plans for the RRF were recast, with a substantial reduction in the number of tankers in favor of a greater number of Roll On/Roll Off vessels. Although this change in plans did affect the *Sagamore*, there was one other opportunity for its upgrade in the mid-1990s. One coastal tanker that was retained in RRF service after 1994 was the *Nodaway*, a former naval vessel that was constructed at the end of World War II. By 1995 it was becoming more difficult to maintain and spare parts were increasingly hard to find. MARAD's regional operations office in San Francisco proposed to upgrade *Sagamore* as a direct replacement for the *Nodaway*, but the proposal was not approved. Consequently, the *Sagamore* was never operated by MARAD or otherwise involved in any RRF operations. From 1998 to about 2005, the *Sagamore* was employed as a fuel storage vessel at the SBRF.

Description/Principal Characteristics of Vessel

Type:	Coastal Tanker
Official Number:	278320
Builder:	Albina Engine and Machine Works of Portland, Oregon
Year:	1959
Sister Ships:	None
Location:	Suisun Bay Reserve Fleet, Benicia, California
Length:	255'
Beam:	42'
Draft (design):	18.56
Depth at side:	21'
Speed:	13 knots

The *Sagamore* is a coastal tanker, built specifically to supply fuel to remote areas of Alaska. It features an all-aft machinery and superstructure arrangement, which had become common before WWII. This arrangement provides for unobstructed carriage of cargo forward of the engine room, and allows for a maximum volume of cargo to be carried for a given length of ship. In order to navigate into the often isolated and shallow villages and towns that it served, the ship's draft was kept to a minimum. A similar vessel today might be substantially similar, except for the fitting of a bow thruster to increase maneuverability, and a double-hull to reduce the risk of oil release in an accident.

The vessel is equipped with 13 cargo tanks and seven cargo pumps allowing for up to seven types of product to be carried in combinations of tanks. The total liquid capacity is 18,399 barrels, or roughly 50% more than the first *Alaska Standard*. At the bow is a single dry cargo hold with a 10,000 cubic foot bale capacity. The hold is serviced by two cargo booms located at the foremast/kingpost, with each boom of three ton lifting capacity. The cargo winches were electric and the topping winches operated on compressed air. The foremast also supports a three-ton hose boom for cargo operations.

Propulsion System and Equipment

Sagamore is propelled by a single non-reversing diesel engine connected to the propeller by a reduction/reversing gear. The main engine is a 1,700 horsepower Nordberg "Supairthermal" Diesel Engine operating at 500 rpm.[3] Caterpillar diesel engines power the ship's electrical generators. The main engine is arranged on the centerline of the vessel, with auxiliary machinery, equipment and systems placed to either side on two levels. This is a common machinery arrangement, similar to many oceangoing and coastal vessels up to the present. Again, a contemporary vessel would likely feature a similar machinery arrangement, although the equipment itself would be modern and probably take up less space in the ship.

The *Sagamore* was not the first diesel-powered vessel in the U.S. merchant marine nor was its machinery arrangement and equipment particularly distinctive at the time it was built. However, it is representative of the transition from steam to diesel propulsion in the U.S. merchant fleet, and remains a prime example of domestic construction during the transition era. Its Nordberg main engine is now a rare surviving example of that manufacturer's work whose significance lies principally in its domestic design origin and construction. Appendix A is a discussion of the development of diesel marine propulsion in the United States, and the significance of the Nordberg company in that development. Appendix B is a status summary of known Nordberg marine engines as of September 2010.

Main Engine Data

Manufacturer:	Nordberg
Model:	Series 13 Supairthermal
No. Cylinders:	8
Cylinder Arrgt:	in-line
Engine Speed:	500 RPM
Engine Type:	Medium Speed, 4 Cycle

[3] Finnish immigrant Bruno V. Nordberg (1857-1924) built the first large diesel engine in the U.S. Built in 1915, it was a five cylinder, 1250 HP two-cycle engine. Nordberg was familiar with the work of Dr. Rudolf Diesel (1858-1913), the inventor of the diesel engine, and secured a license agreement to build engines in the U.S. He soon became the primary builder of heavy-duty diesel engines in the western hemisphere. He founded Nordberg manufacturing in Wisconsin in 1889, which manufactured valve engines, pumps, hoists, compressors, and similar equipment.

Above: *Sagamore* Main Engine, starboard side shown, looking aft towards reduction gear at lower level.
Below: *Sagamore* Main Engine, starboard side shown, looking forward from upper level engine room.

Statement of Significance

The *Sagamore* is a typical small coastal tanker, a type of vessel that is ubiquitous in service and that has been represented by thousands of similar vessels in domestic and international trade. The basic design and arrangements of coastal tankers has not substantially changed in the past 75 years. Although designed for the specific requirements of the Alaskan coastal trade, it does not exhibit any particular features or arrangements that distinguish it from the broad population of vessels of this type.

Despite its generic insignificance, the *Sagamore* is nevertheless important as a surviving example of the transition from steam to diesel propulsion in the U.S. merchant marine. In particular, the ship's main propulsion engine, a 1,700 brake horsepower Nordberg Series 13 "Supairthermal" 8-cylinder, in-line, four cycle medium speed diesel, is one of very few surviving examples of this type, and one of only eight Nordberg marine engines[4] known to exist in the United States today. It is a signature marine engineering artifact.

Integrity of Characteristics/Features

The vessel was originally constructed in 1959 and did not undergo any substantial modifications during its service life. Certain pieces of equipment have apparently been replaced during the course of the ship's service, as is typical. It appears that at least one of the lifeboats was replaced at some time prior to the ship's acquisition by MARAD. Otherwise, the vessel retains its historical integrity, being substantially unchanged from original construction. All (or most) salient design features of structure, machinery, and equipment are substantially intact. The vessel's physical integrity is slightly degraded, and the vessel's overall condition is fair.

National Register Eligibility Statement

The *Sagamore* was a one-off design. It had no sister ships and apparently did not influence the design of vessels to follow. It was built for a specific service that could be handled by one ship, and performed its work successfully for almost three decades. An article in the November 1959 issue of "Marine Engineering "says the ship would serve "...over a hundred towns and wharves. Some little more than a couple of piles connected with a plank. The ship's shallow draft (18.5 feet) permits landings at many out-of-the-way inlets and ports." The vessel does not represent a revolutionary design, other than the fact that it was larger than its predecessor and

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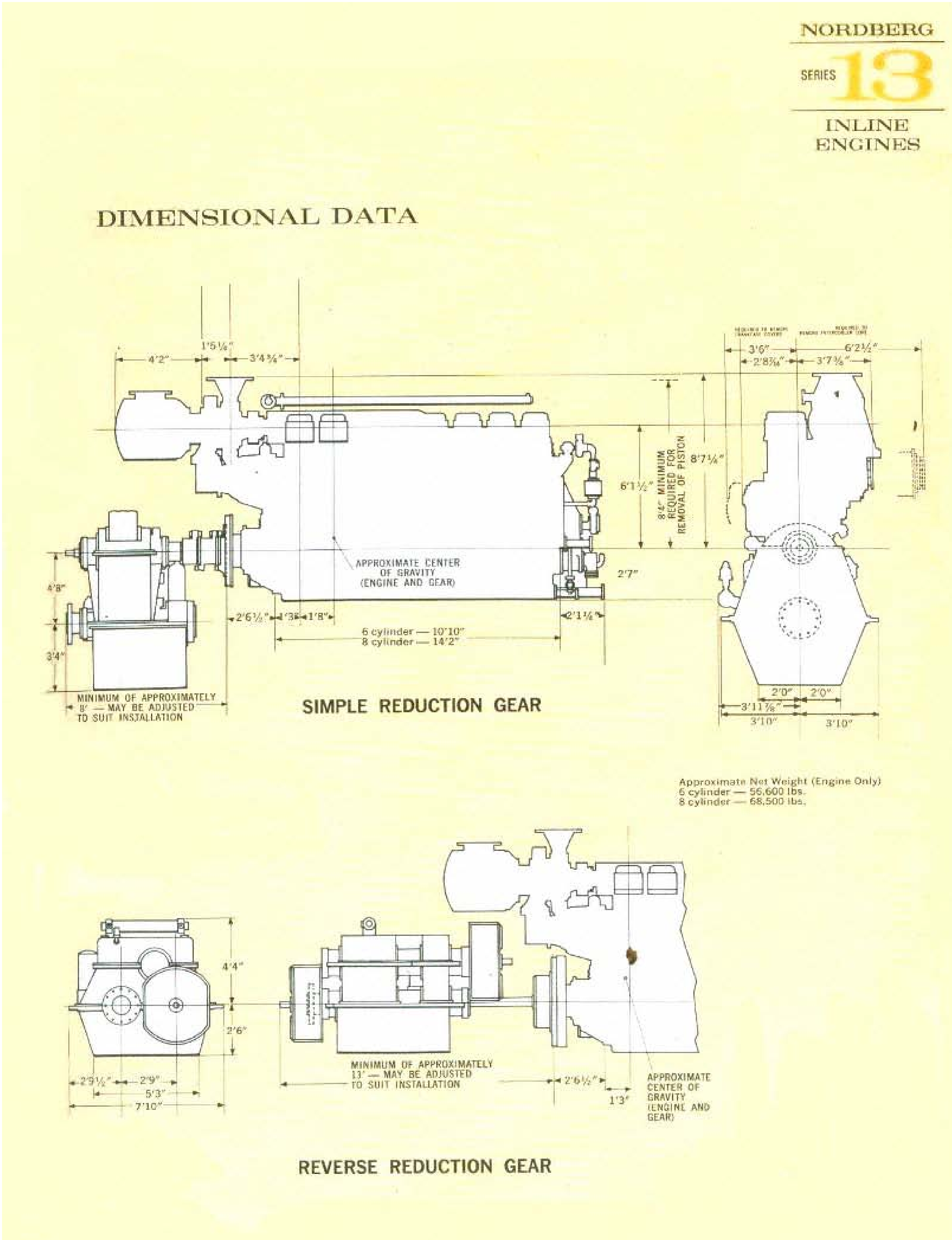
4 Most surviving Nordberg engines are stationary engines constructed for power generating stations or other industrial purposes. As of September 2010, five marine engines appear to exist in three Great Lakes vessels; of which only one vessel is in service. A vessel scrapped in 2008 was fitted with a Nordberg engine; the fate of that engine is unknown. Outside of the Great Lakes, one former Maritime Commission vessels that was fitted with two Nordberg engines was scrapped in Texas in 2009; those engines were destroyed in the process. A second ex-Maritime Commission vessel will likely also be scrapped in the near term. The former *Hughes Glomar Explorer* is fitted with five Nordberg diesel main propulsion generators; those engines were retained when that vessel was converted into an oil exploration drilling ship and returned to service in 1998. The vessel is now privately owned by the Transocean Corporation, and operates outside of the United States as the *GSF Explorer*. The former Army Corps of Engineers towboat and inspection vessel M/V *Mississippi III* is fitted with two Nordberg Series 13 engines. That vessel has been preserved in Vicksburg, MS.

therefore able to transport more fuel. It did not influence the design of future tankers.

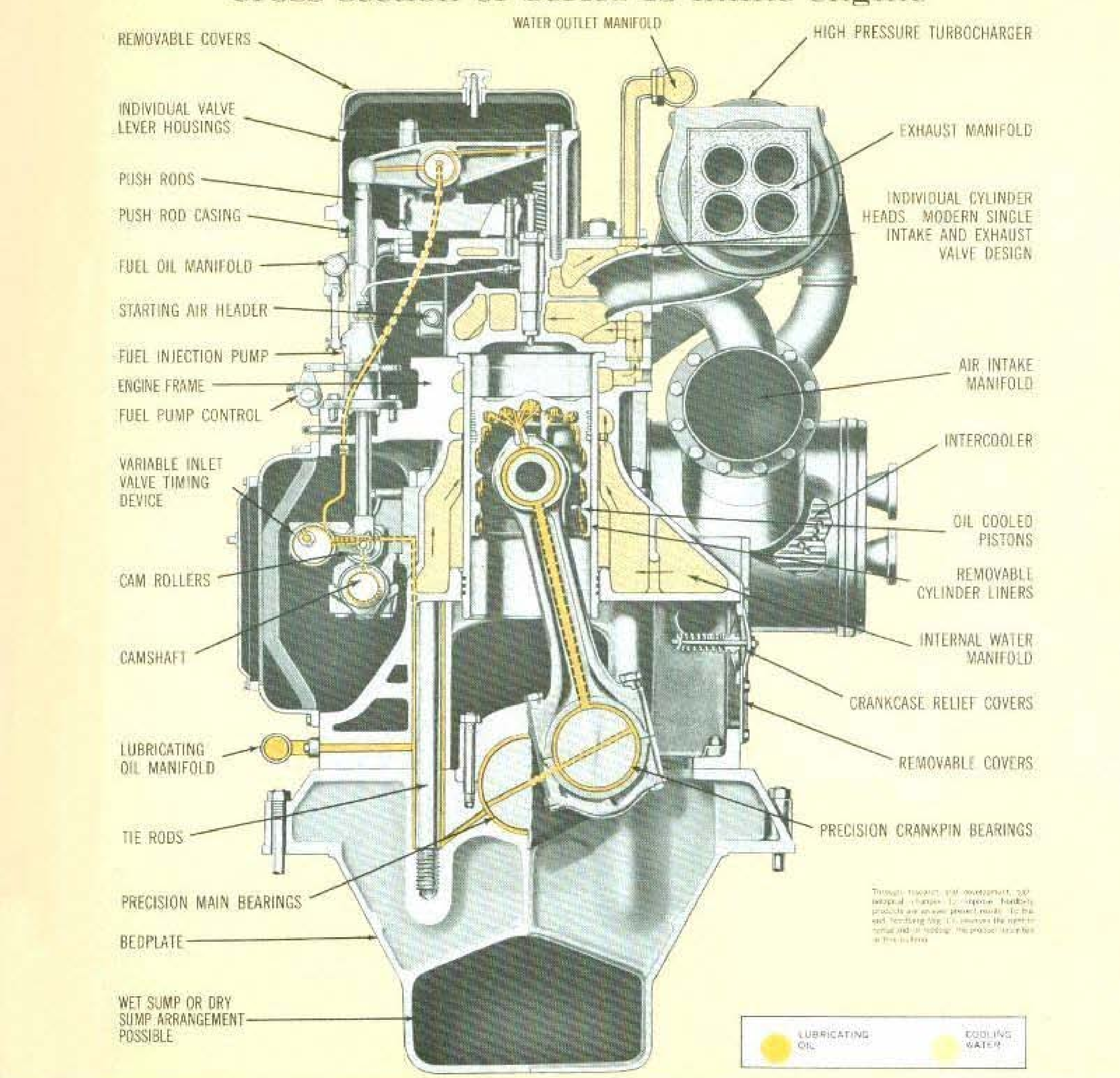
The surviving Nordberg engine is a significant artifact in the context of marine diesel propulsion.

Date: October 1, 2010
Determination: NOT ELIGIBLE

Nordberg Series 13 Diesel Engine – from vintage company sales brochure



Cross section of Series 13 inline engine



FUELAIRTROL air-fuel ratio control system

Fuelairtrol, by anticipating changes in load prior to the engine governor demand for a fuel increase or decrease, supplies the correct amount of air within the cylinder for each load condition. This is accomplished by sensing load variation at its source and adjusting the intake manifold pressure accordingly.

Because of the constant "feedback" compensation provided by Fuelairtrol, the engine receives the precise mixture of fuel and air for most efficient combustion at every load and ambient condition, improving both engine performance and fuel economy.

The Tougher the
MARINE JOB
the more you need
Nordberg power

Powerful, responsive, compact and easy to service, Nordberg Series 13 Inline Engines have what it takes to log round-the-clock dependability for work boat or motor ship propulsion or auxiliary service.

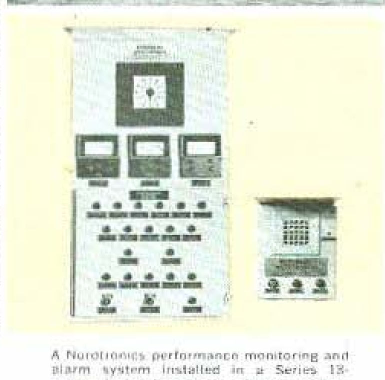
Available for single or multiple screw installations, with any type of marine drive.

Foss Launch and Tug Co. tugboat HENRY FOSS is powered by a pair of 8 cylinder Series 13 Inline engines providing a total of 5,000 hp. These engines, OPERATING ON INEXPENSIVE BLENDED FUEL OIL, deliver the sort of smooth, reliable performance usually associated only with lighter fuels.

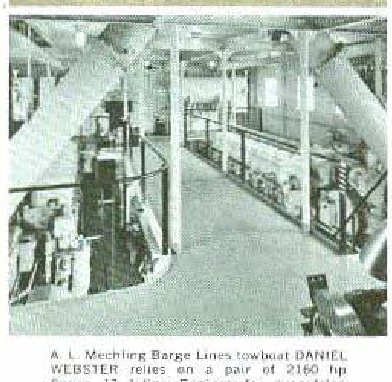
Propulsion power aboard the M/V MISSISSIPPI, 271 foot U.S. Corps of Engineers towboat, is furnished by a pair of 1860 hp Series 13 Inline diesels.

Standard Oil Company's 255 foot tanker ALASKA STANDARD is powered by a 1700 hp Series 13 Inline engine.

Each of the two 1620 hp Series 13 eight-cylinder diesels aboard the dredge FRITZ JAHNKE drives three generators — two DC and one AC — in tandem, providing all dredge operating power except for main dredge pump power.



A Nurotronics performance monitoring and alarm system installed in a Series 13-powered vessel monitors exhaust gas temperature, jacket water temperature, lube oil pressure and temperature, control air pressure, etc. The smaller panel advises the pilot house of engine condition automatically.



A. L. Mechling Barge Lines towboat DANIEL WEBSTER relies on a pair of 2160 hp Series 13 Inline Engines for propulsion power.

Sources

Brouwer, Norman. *Sagamore Ship* History. 2006.

Maritime Administration Ship Survey Report, prepared by Henry D. Ryan, Marine Surveyor. Date of survey, December 3, 1986.

SNAME *Marine Engineering, Volume One,* 1941.

Internet Sites

Maritime Administration's Property Management and Archive Record System Website: https://pmars.marad.dot.gov/detail.asp?Ship=4264

www.oldengines.org (for Nordberg catalog pages)

Appendix A

The Steam to Diesel Transition

The following discussion is based on the text *Marine Engineering, Volume One*, published by the Society of Naval Architects and Marine Engineers in 1942; *Modern Ship Design, Second Edition* by Thomas C. Gillmer, published by the Naval Institute Press in 1975; and *The History of Ships* by Peter Kemp, published by A&W Publishers, Inc of New York, NY in 1979.

Today, the vast majority of the world's merchant fleet is powered by some method of diesel propulsion. The types of diesel engines and the means by which their power is transmitted to a propulsor vary widely, and continue to evolve today. Steam propulsion is now found in rather limited applications, principally large naval combatants, nuclear-powered vessels, and Liquefied Natural Gas (LNG) tankers which employ "boil-off" gas to fuel their boilers. Diesel propulsion had its first serious oceangoing application in 1912, and by 1940 some twenty percent of the world's merchant fleet was diesel propelled[5]. The diesel revolution accelerated rapidly in the post WW2 era, except in the United States. For a variety of reasons, oceangoing U.S. merchant ships continued to be constructed and powered by steam turbines until the late 1970's, by which time the U.S. was essentially the "last bastion" of marine steam engineering.

The application of mechanical power to ship propulsion is rooted in the first riverine steam boats of the early 1800's. The first oceangoing steam ship was the U.S. flagged vessel *Savannah* of 1819; however, it would take nearly 30 more years for steam to become a practical and reliable mode of oceangoing propulsion and begin to replace wind-powered ships in large numbers. In the U.S. inland and coastal trades, steam boats rapidly replaced sail and provided the proving ground for evolutions in marine steam equipment and propulsion technologies that were later applied to oceangoing vessels. Although the United States produced vast numbers of river, inland waters and coastal steam boats with highly developed technologies, its oceangoing merchant ships remained predominantly wind-powered well into the 1860's. One factor that applied was the continued reliance on wood as a structural material in the United States well after iron hulled ships appeared in Europe. Wooden hulls had practical limits, and were less suitable for the growing size and complexity of oceangoing steam propulsion plants. The vast stands of North American timber were an inexpensive resource that outweighed the technological advantages of iron construction; consequently, U.S. oceangoing maritime development focused on wind-powered wooden packets and clipper ships, rather than iron-hulled steam ships. The U.S. oceangoing merchant fleet suffered substantial losses during the Civil War, and did not recover for many years thereafter, by which time the European merchant fleets had captured much of the Atlantic trade formerly held by U.S. ships. This experience would generally be repeated eighty years later in the transition from steam to diesel.

By the turn of the 20th Century, reciprocating marine steam engines of the triple expansion or

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5 SNAME *Marine Engineering, Volume One*, 1942 page 11.

four-cylinder compound types were the dominant forms of oceangoing propulsion power. The steam turbine was introduced early in the 20th Century, but required the development of high power reduction gearing before it could come into widespread use. The complexity and cost (in space and weight) of the gearing was such that steam reciprocating engines remained common well into the 1930s, and saw a respite during WWII before finally being eclipsed. Thereafter, the geared steam turbine remained the dominant form of steam propulsion.

As reciprocating engines became common, engineers sought to develop internal combustion reciprocating engines, both to improve overall thermal efficiency (and reduce fuel consumption for a given horsepower), and to eliminate the need for external boilers to produce the steam necessary to drive the engine (saving substantial weight and space). Two competing forms of internal combustion reciprocating engines were developed; the gasoline engine and the diesel. The diesel was particularly well suited to large industrial applications such as power generation, railway locomotives, and marine propulsion, whereas the gasoline engine soon found applications in the automotive, trucking and aviation fields. Although large reciprocating engines are more maintenance intensive than rotating machinery (such as steam turbines) for a given power, the internal combustion reciprocating engine offered substantial advantages in fuel consumption, maintenance and repair times and labor costs. These factors contributed greatly to the widespread adoption of diesel engines in the marine and railway sectors, and in low to moderate power generation plants. In the United States,

The development of diesel marine propulsion in the United States in the early 20th Century followed a pattern that is similar to that which surrounded the development of steam powered vessels in the previous century. In the early - mid 1800s, steam propulsion rapidly expanded on river and inland waters vessels, where its mechanical independence from the vagaries of wind and tide offered substantial economic advantages. These same characteristics were less applicable to large oceangoing merchant ships, which remained largely wind-driven until the post Civil War timeframe. The development of internal combustion engines near the turn of the 20th Century offered many economic advantages over steam. Initially these advantages could most effectively be employed in smaller, lower-powered vessels where space, weight and personnel were premiums[6]. Owner/operators of tugboats, towboats, self-propelled lighters and various other types of river and inland waterways vessels quickly grasped the advantages offered by diesel propulsion, and by the 1920s and 30s were either constructing new vessels fitted with diesel propulsion, or converting existing vessels from steam to diesel. The trend closely followed the developments in the railroad industry, which utilized engines of similar size and power. As with the railroads, however, a full scale transition to diesel propulsion was delayed, first by the economic effects of the Great Depression, and later by the production limitations of the Second World War.

6 A steam-powered vessel requires one or more boilers to burn the fuel and produce steam. The steam drives one or more engines (reciprocating or turbine) to produce the power to propel the ship. An internal combustion engine dispenses with the need for boilers and their operators, resulting in an overall reduction in weight, space and crew for any given amount of power. The engine itself, however, requires more frequent and more intensive maintenance. On balance, the diesel has favorable economics in most applications.

The Nordberg company was the earliest producer of practical diesel engines in the United States, and by the 1920's it was one of the few domestic manufacturers of large industrial and marine diesel engines. During the transition era it was the major supplier of marine diesels for U.S. flag operators of medium and large vessels. Its major competitors in the post WW1-era were Fairbanks-Morse and Cooper-Bessemer. Major shipbuilders such as Bethlehem Steel Corporation, Sun Shipbuilding, and Newport News Shipbuilding also manufactured engines, either under license from European companies (Werkspoor, Burmeister & Wain, Doxford, and Sulzer), or of their own design. The shipbuilders typically supplied engines only for ships constructed in their own plants, whereas Nordberg, Fairbanks-Morse and Cooper-Bessemer were suppliers to any shipowner.

The United States Government took several opportunities to spur the development of diesel engines for large oceangoing ship applications, with a goal to improve the competitiveness of the merchant marine. As part of the large ship construction program during World War 1, the United States Shipping Board (1916-1933) fitted diesel propulsion to several of its standard ship designs and performed comparison tests against comparable steam-powered vessels. By 1921 the Board concluded that the diesel ships compared favorably to their steam-powered counterparts, with the economic advantage held by the diesel ships. Despite this finding, few operators chose to construct diesel-powered ships for international trade. Twenty years later the United States Maritime Commission, successor to the Shipping Board, included diesel propulsion options in its portfolio of standard replacement ship designs, but again with little operator interest. With the outbreak of World War II, the Commission faced a severe shortfall of modern steam turbine units for its replacement and emergency ship production programs, because the manufacturing capacity for that equipment was needed for naval combatant vessel programs. The Commission turned to older-style steam reciprocating engines and diesels to provide the large quantities of equipment needed to propel the ships of its vast shipbuilding program.

By the time that the Maritime Commission began constructing diesel-powered ships in large numbers, the production capacity of most diesel engine suppliers had been spoken for by the Navy. In particular, Fairbanks-Morse was devoting nearly all of its capacity to production of engines for submarines and other small combatants. Nordberg, which also maintained a large capacity for producing steam reciprocating engines, became the major supplier for the Maritime Commission program.

Appendix B - List of known Nordberg Marine Diesel Engines - September 2010