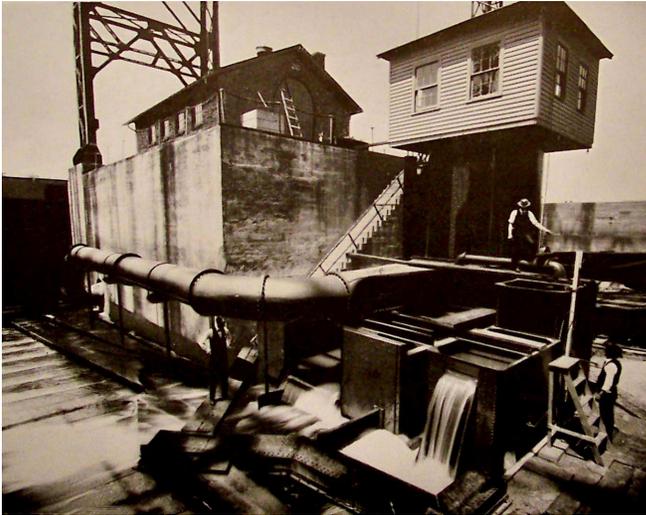


# ***AN 'INDUSTRIAL REVOLUTION'***



***HYDRAULIC TESTING FACILITY, LOCATED IN THE OUTBOARD END OF THE OLD SEMI-SEMERGED SHIPWAYS #8 & #9. IT WAS OPERATED BETWEEN 1923 AND 1933 TO SUPPORT NNS HYDRO-ELECTRIC TURBINE DEVELOPMENT AND WAS DESIGNED AND POSITIONED SO AS NOT TO INTERFERE WITH NORMAL SHIP CONSTRUCTION AND LAUNCHING OPERATIONS.***

## ***NNS' Innovative Answers to a Naval Shipbuilding Hiatus***

**INTRODUCTION:** When World War I ended, the Navy had a huge number of warships and naval auxiliaries afloat, plus many more under construction. In 1918, shipyards all over the United States were sent cancellation orders for almost all of the government's contracts. Newport News Shipbuilding was hit hard.

Battleships, battle cruisers and several smaller naval vessels on the ways at NNS were scrapped. Employment tumbled from 10,000 to about 4,000 in just a few months. The only bright spot in this scenario was shipyard president Homer L. Ferguson's ability to get the Navy to allow a battleship that had already been launched to be completed.

A naval shipbuilding 'holiday', as it was called, lasted more than a decade. Between 1918 and 1931, the Navy only ordered two warships to be built at Newport News. Commercial ship contracts, while occasionally available, were in short supply. Many naval auxiliary vessels had been given to domestic shipping companies to replace their wartime losses.

By 1922, the yard workforce was down to two thousand. Forced to find other sources of business in order to survive, the shipyard logically shifted some its efforts to ship conversion and reconditioning projects; albeit mostly at cutthroat prices. More often than not, those proved unprofitable. But that program did keep a core of skilled shipbuilders on the rolls, a brave move which paid off when traditional shipbuilding work resumed.

In order to help stay in business, NNS also embarked on an imaginative program of diversification; the most successful and long-lasting of which was the manufacture of equipment for hydro-electric power plants. For NNS craftsmen, it was an industrial revolution of sorts and included a variety of items other than hydro-electric equipment.

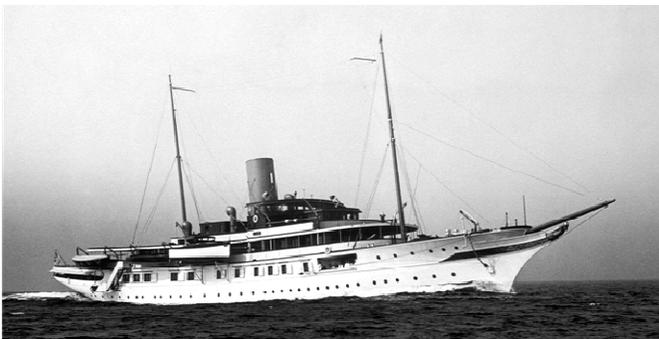
**MARITIME-RELATED DIVERSIFICATIONS:** One obvious answer to the Company's dilemma was to build just about anything that could float. In the lean years for shipbuilding between the two world wars, NNS bid on every possible maritime-related contract, often competing with much smaller companies to build minor vessels not really well suited to the facilities at Newport News.

As a result, Newport News Shipbuilding built five tugboats, a large number of barges for a wide variety of usages, plus a few dump scows, car floats and dredges. Given NNS hull numbers, most of these workboats, with the exception of the tugs, had no propulsion machinery. In addition, most were not given names or christened when they first became waterborne, including four of the tugs. One tug, built for the C&O, was given a name, but was floated off the end of Shipway #8 without benefit of a sponsor or ceremony. Several were built at a loss, but the volume of work they provided helped the Company survive.

The shipyard's most interesting line of small vessels, built in the 1920's, was a series of ten yachts. All of them were built at a loss. 'The Rock' had been unveiled in 1917, in better times. Its altruistic motto soon became all too realistic. In spite of the monetary disappointments associated with the yachts, they were well-built, steel-hulled vessels.



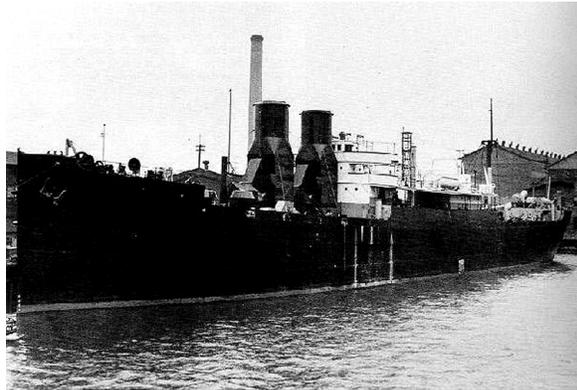
The largest and most beautiful was the steam-powered VIKING (NNS Hull #328), which measured 272 feet in length and featured turbo-electric drive. She was a good example of the extremes that the design of large yachts reached before the Great Depression ended an era of maritime opulence created by multi-millionaire yachtsmen.



Requisitioned by the Navy during World War II, she became a patrol gunboat. In January of 1944, while leading a convoy, she was struck amidships by a tanker off the New Jersey coast. She sank in only five minutes in frigid waters. Just 30 members of her 145 crew survived.

The most famous of the non-profitable ship conversions undertaken was the rebuilding of the former German liner VATERLAND. Taken over by the United States during World War I, she had been renamed LEVIATHAN and used as a troop ship. Her conversion to a passenger liner in 1922/1923 resulted in a huge financial loss for the shipyard. That story is well known to NNS history buffs and is particularly well-chronicled in the Company's centennial book, *NEWPORT NEWS SHIPBUILDING; THE FIRST CENTURY*. Further amplification here would be redundant.

Less well known is the work done in 1930 to convert a freighter into the world's first floating power plant. Assigned NNS Hull #343, the JACONA, a mid-sized freighter, had her propulsion plant and cargo handling gear removed. Four oil-fired boilers and two turbine-driven, electric generators were then installed. Towed to Maine, she served as an emergency power source in the New England states for some years, and later overseas.



**AN ECLECTIC MIX:** During the nineteen twenties, the shipyard tried its hand at building a number of unusual products not even remotely related to shipbuilding. Included were two machines called Luce Cane Harvesters, used for harvesting sugar cane. These large and complicated pieces of farm equipment were assembled in the Hull Fitting and Plant Shop at Newport News. The first field test of these machines was conducted under the direction of the assistant foreman of HF&P.



Other unlikely products were Millikin Traffic Signal Lights and Hall Flexslient Disc Wheels for automobiles. The traffic lights were built of sheet metal. Less than a hundred of these ornate stop-and-go signals were built at NNS. But one of them was mounted on a pedestal in the center of the intersection of 34<sup>th</sup> Street and Huntington Avenue during the 1920's.

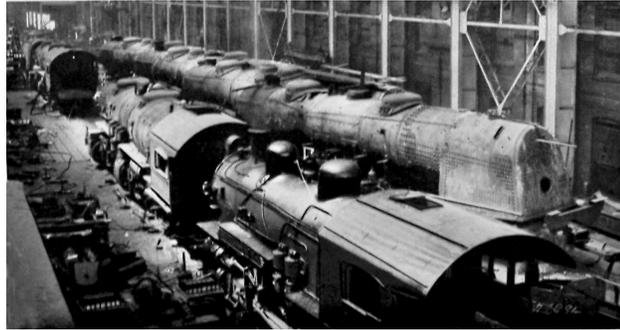
The Flexslient wheel was disc-type wheel assembly created to reduce road shock experienced when high pressure tires were being used. It became obsolete when lower pressure 'balloon' tires became the automotive industry standard. Roughly 4,000 of these riveted wheels were built in the old



Mold Loft. This product lines was not profitable, but they did help keep a few men at NNS employed.

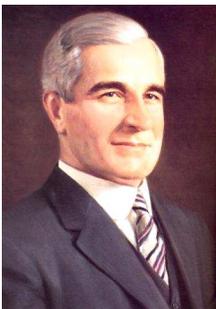
One of the largest and, thankfully, more financially successful line of work undertaken was the repair of railroad steam locomotives, and the construction and rebuilding of railroad cars. Although this activity required a substantial investment of about \$250,000 in railroad-related manufacturing and overhaul tooling, it resulted in a large volume of profitable work for NNS craftsmen in the early 1920's.

**RAILROAD WORK:** The rebuilding of railroad steam locomotives was done for the C&O Railroad. In 1924 and 1925, a total of 157 locomotives were overhauled in the Company's Erecting Machine Shop. During this same time period, in addition to manufacturing replacement parts for use in this locomotive overhaul work, similar parts were made for two other southern railroad firms.



On the yard's north side, near the old semi-submerged Shipways #8 & #9, a production line was established for the assembly of coal and box cars. The machine shop made many of the parts needed for this work. The foundry mass-produced wheels and axles.

At a production rate of 15 cars a day, a short-lived shipyard entity called the Car Department eventually turned out 1,500 coal cars and 500 box cars for the C&O, plus about 2,500 railroad cars for other companies. Assembly work took place in the open, using multiple railroad tracks installed to facilitate that operation. In addition, the Company rebuilt 500 coal cars for the Norfolk & Western Railway. All of this latter work took place fully exposed to the elements, as did so much of 20<sup>th</sup> century shipbuilding.



It is estimated that, collectively, these railroad-related efforts kept more than one thousand men on the payroll during 1922 and 1925 who might otherwise have been laid off. But the work, however welcome, did not...could not...satisfy the spirit of skilled shipbuilders. Including shipyard president Homer L. Ferguson, who noted in an oft-quoted speech which he made during those lean shipbuilding years:

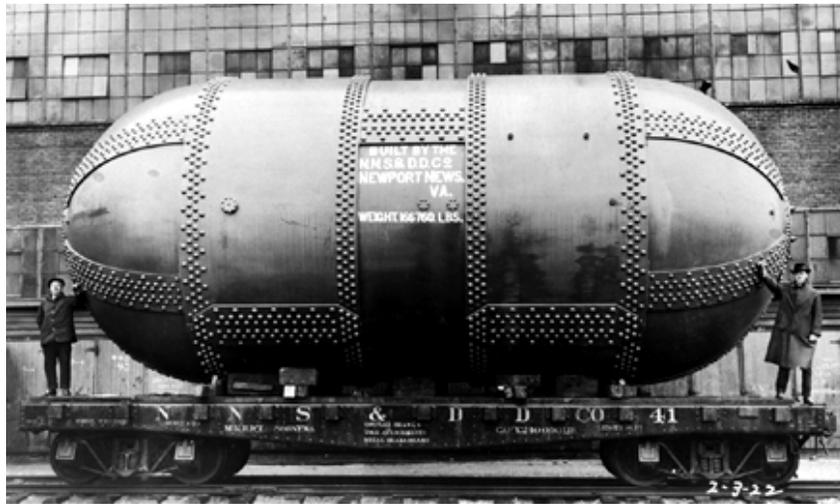
*"I suppose it is fortunate we can do something else. We can build turbines and box cars; we can beat swords into plowshares and pruning forks; but no man born or bred to the business of building ships can get enthusiastic about it."*

Tears reportedly filled his eyes as he paused. His voice broke as he rhetorically asked:

*"Who can love a box car?"*

**A WIND TUNNEL FOR NACA:** By 1921, a government entity, the National Advisory Committee for Aeronautics (NACA – now NASA) had established research facilities at Langley Field. NACA wanted to create a wind tunnel that could be pressurized to twenty atmospheres. Such a device, the first high-pressure tunnel of any size required a thick-walled vessel; something that NNS could...and did...build.

The next year, this huge, heavy structure was ready for shipment by rail car the few miles between NNS and Langley Field. The vessel measured over 34 feet in length, 15 feet in diameter and had steel walls over two inches thick. Its total weight exceeded ninety tons.



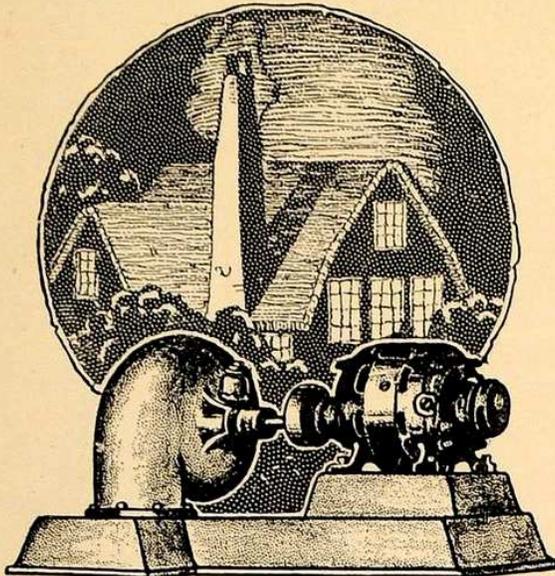
This NNS-built industrial icon served NACA well into the 1940's and contributed to the design of numerous World War II combat aircraft. When its utility was surpassed, technologically, NNS built much larger wind tunnel sections for NACA in the 1960's.

Placed on the National Register of Historic Landmarks, it has been nicely restored to near-original condition and is on display at Langley Field.



**EVEN A RETAIL ENTERPRISE:** In 1924, NNS obtained the patent rights to an invention called the Hydrolite Turbine System. This compact system was manufactured in Newport News and marketed primarily to farmers. It featured a small, low-head hydraulic turbine that was directly connected to an electrical generator which, in turn, fed a storage battery. Designed to be situated next to a flowing stream or other water source that would produce a free energy source, the system was built in four sizes. The smallest one provided 150 watts of power at a voltage of 32.

## The NEWPORT NEWS HYDROLITE



### Electricity Costs Little if You Harness the Brook, Spring or Artesian Well

At last a home light and power plant has been perfected that utilizes the power going to waste on thousands of country estates.

Little streams bridged by 6-foot logs often generate all the current needed. Dams are seldom required. Artesian wells and springs with high heads op-

erate it. It is known as the Newport News Hydrolite.

Light, running water, refrigeration and cooking heat are supplied at no expense for fuel.

It runs under low and medium heads with smaller quantities of water than have heretofore been used. Write for catalogue and complete information.

NEWPORT NEWS SHIPBUILDING & DRY DOCK CO.  
Box 105, Newport News, Va.

The largest hydrolite model manufactured produced 500 watts of power at 110 volts. Site selection, installation and operational instruction was often provided by the Company's engineers.

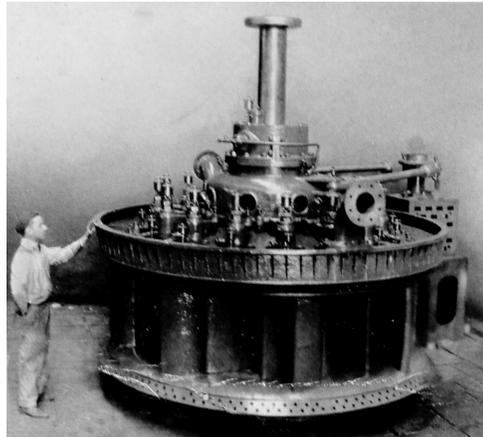
Units in all four sizes were built on 'spec' and kept in stock, thus assuring rapid delivery. The largest model was advertised as being capable of furnishing current for eighty 25-watt light bulbs for six hours, or for providing electricity to run multiple pieces of farming equipment.

The first NNS-built hydrolite turbine was put through its paces in the hydraulic test facility located on the waterfront. Eventually, development of more versatile and economical gasoline engines to power self-contained electrical supply systems resulted in discontinuation of this retail product line by NNS.

**ESTABLISHING A PRE-EMINENCE IN HYDRO-ELECTRIC:** When Company officials considered what kinds of business NNS might enter to augment its slim backlog of ship-related work in the 1920's, one industrial market readily came to mind. The design and construction of hydraulic turbines and associated equipment for electric generating stations was an ideal fit for the firm's engineering and production skills.

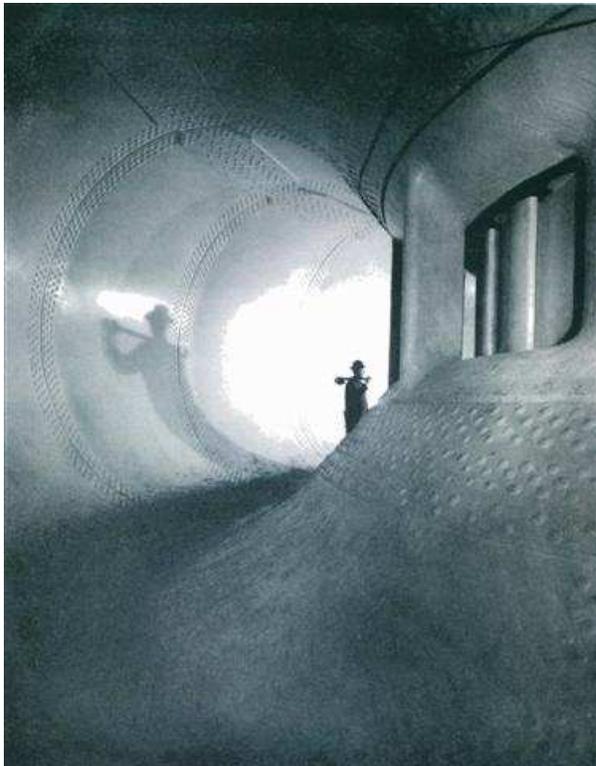
Like many ships, each hydro-electric plant had to be uniquely designed to suit a particular site. These custom jobs required the best thinking of engineers and designers, as well as the creation of large-scale castings, precision machining and careful assembly and alignment of multi-ton components. In most cases such large projects had to be erected on the platens of Newport News to insure proper fit-up, then match-marked and shipped in pieces by rail or barge to remote dam sites all over the world.

It didn't take long for Newport News Shipbuilding to land its first contract in the hydro-electric marketplace. On November 10, 1922, the Company contracted to build its first hydro turbine with the Virginia Electric & Power Company [Shown here, following shop assembly]. Rated at 3,000 horsepower, it was installed near Petersburg, Virginia the next year and remained in operation for several decades.



A second order was obtained in November of 1923, followed by two more in 1924. The average contract price for this somewhat humble beginning was only \$14,500. Including training, tooling and the creation of the yard's first hydraulic test platform, the cost of entering this line of business exceeded that figure by several times.

The wisdom of this investment was quickly realized. The performance of NNS' early-built turbines surpassed both owner specification and expectation. As a result, in May of 1924 the Company landed a contract to build four 35,000 horsepower units for a huge dam and hydro-electric project on the Tennessee River. This work was worth \$425,000 [in 1924 dollars] and included a spare turbine runner, sixty-two regulating and lock gates, plus a 35-ton gantry crane. NNS was in the water power equipment business to stay.



Over the next few years, what had become formally known as the shipyard's Industrial Products Division booked numerous additional hydro-electric units. Many of these orders included mechanical rack rakes for keeping trash out of the turbine units, as well as spiral casings and huge gate valves for channeling water into the turbines' intakes. The size of the larger of the spiral casings can be appreciated by looking at the photograph on the left.

Over the next few decades, NNS hydro-electric machinery was provided to a number of domestic utilities. Relatively small units were installed in New England and in the several Southern states. Larger units went to TVA, and the very largest ones manufactured ended up in the nation's western states.

Sub-assembly shipments and entire turbine runners were often shipped from Newport News using railroad cars designed, built and owned by the Company. But as water power equipment grew larger, most shipments had to be made by barge, then hauled overland to construction sites by multi-ton, multi-wheeled transporters too large for public highways.

The largest installations were at Hoover Dam, in Nevada and at Grand Coulee Dam in Washington State. Both of these installations took place in the 1930's, after the shipbuilding business at Newport News had recovered. To illustrate how much bigger hydro-electric turbines had gotten, the first NNS unit sold was rated at 3,000 horsepower. But the fifteen units built by NNS and installed at Grand Coulee [including several units built following World War II] had a combined horsepower of 2.34 million horsepower. One of these latter units is shown below during field assembly.

NNS engineers supervised the installation and start-up of most of the units furnished by the shipyard. In addition to traveling to roughly two-thirds of these United States, they also went to foreign countries.

For one notable job, they had to go to the Soviet Union...twice. Before World War II, a team of several Newport News engineers supervised the installation of some of the water power equipment at the Dnieprostroi Dam. This facility was severely damaged during the war by both the Soviets and the Germans as war raged back and forth over its site. When replacement equipment was ordered from NNS and shipped in the late 1940's, some of the same engineers went back...this time working under much stricter security behind the Iron Curtain.



What had started out as a minor effort to help keep skilled shipbuilders on the Company's rolls ended up becoming a very large [\$20 million by 1948] and profitable line of business for Newport News Shipbuilding. It was not until building dams became virtually impossible due to environmental concerns that this activity ceased at NNS.

**HISTORY REPEATS:** Following World War II, several Navy contracts were cancelled. A few warships under construction at NNS were completed, but others were scrapped on the ways. Employment declined drastically and the Company again sought ways to partly replace a huge loss in backlog. One such effort was a bold decision to buy about a dozen war-weary ships. Some were converted to peaceful uses, when customers for them could be found. Others were scrapped, their steel and other metals sold for a small profit.

As had been experienced after World War I, the yard partly made up for a lack of new ship construction work by taking on a variety of ship conversion work; both military and commercial. Throughout both world wars, and in the years following each conflict, the ship repair business flourished. It was not uncommon during much of the 20<sup>th</sup> century to see a dozen or more ships alongside piers and in the Company's dry docks.

**LEGACY OF THE 1920's:** Between 1945 and 1965, the shipyard accepted orders for a wide range of industrial equipment, large and small. The variety of these orders even exceeded those of the 1920's. In addition to a number of water power equipment orders following World War II, a much larger wind tunnel was constructed for NACA in 1949. So big, it had to be assembled on a north side platen, as depicted below, match-marked and then transported to Langley Field piece-meal for final assembly.



Another large scale project was the manufacture of six caissons for the York River Bridge. These steel 'boxes', which measured 66 by 52 feet in cross-section and stood 110 feet high were built in Shipway #10. When completed, they were towed to the construction site, filled with concrete and sunk to support the bridge's structure. Relatively smaller jobs later undertaken included the manufacture of paper dryers and pressure vessels for the chemical industry.

In 1955, before Newport News Shipbuilding began to build nuclear-powered naval vessels, the Company undertook the manufacture of several, relatively small homogeneous reactors for Oak Ridge National Laboratory. This work included development by shipyard engineers of techniques for cladding carbon steel with stainless steel, and for welding an exotic metal previously unknown to shipbuilders: Zircaloy-2.

These techniques proved invaluable a few years later, when the Company fully embraced the nuclear age and began building nuclear-powered submarines, the aircraft carrier ENTERPRISE and its propulsion plant prototype in Idaho. Construction of the prototype was handled by the Eastern Idaho Construction Company, a NNS subsidiary created for just that purpose.



This accumulation of knowledge led to modification and maintenance work at other land-locked naval installations. Plus, a few years later, work at Department of Energy nuclear sites. By 1973, most of the Industrial Products Division's traditional work activities had faded away as the design and construction of nuclear-powered vessels, plus refuelings and major overhauls for the Navy began to completely dominate the scene at NNS.

Somewhat as a result, and also because of strong competition, the yard's traditional ship repair business and commercial ship construction efforts largely became a thing of the past. The once-important need to market and make industrial products also waned.

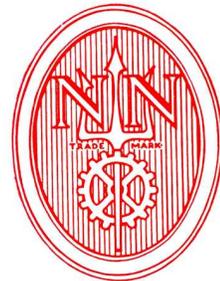
The Industrial Products Division completely disappeared in 1973. A strategic shift in marketing the firm's talents outside the realm of shipbuilding resulted in the creation of Newport News Industrial, a shipyard subsidiary formed to concentrate on nuclear and fossil power plant work...work that continues today...and offers future promise.

The innovative industrial ideas that helped Newport News Shipbuilding stay in business in the 1920's were filed away and largely forgotten. Or, perhaps not...

**POSTSCRIPT:** Everyone knows this familiar saying: Those that ignore the past are doomed to repeat it. Although the volume of naval shipbuilding and related work still goes through up-and-down cycles, with another one apparently coming soon, hopefully NNS will not be faced with as dire a situation as it experienced ninety-plus years ago.

I have no idea what contingency plans the Company or the leadership of its parent firm may have in mind to cope with such a reoccurrence. Or what strategies they may already have in advanced planning or even actual development.

But I am confident that they, like Homer L. Ferguson and his associates, have...will have...or will find strategies to help keep Newport News Shipbuilding viable in future times of adversity. I have seen indications that the Company's current leadership appreciates the shipyard's history and has learned from it. The return of 'The Rock' to its original position inside the shipyard, and recent reuse of this logo, which dates back to at least the 1920's, are all good signs.



But just in the improbable case that the lessons of history are not fully appreciated, this article may provide some food for thought. No charge!

*Bill Lee*  
March 2013