

SHIP IN THE DESERT

~ Introduction ~

The USS ENTERPRISE (CVN-65) is universally recognized as the world's first nuclear powered aircraft carrier. However, her novel propulsion plant was not. That distinction belongs to a curious land-locked naval facility located hundreds of miles from the ocean in a remote part of Eastern Idaho.

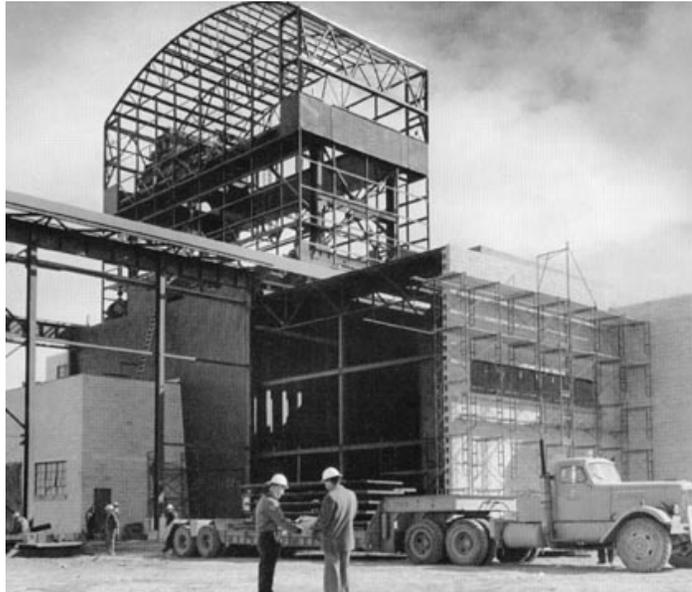
This is the story of that unusual first in modern aircraft carrier propulsion plant development, and the significant part played in its construction by Newport News shipbuilders, many of whom were graduates of the company's Apprentice School.

A ride west of Idaho Falls on State Highway 20 is a vicarious visit back in time to early days in nuclear reactor technology. The average traveler sees only a few historical markers, hundreds of **US GOVERNMENT PROPERTY – DO NOT ENTER** signs, and only has distant and indistinct glimpses of widely dispersed, non-descript structures that seemingly hover on the horizon.

It was here; at the Atomic Energy Commission's National Reactor Test Station (NRTS) that many experimental and one-of-a-kind nuclear reactors were developed in the 1950's. It was here that electricity was first generated by nuclear fission. It was here that an improbable nuclear-powered aircraft engine was tested. And it was here that the Navy built its first reactor plant prototypes, to demonstrate the feasibility of nuclear propulsion for shipboard use, and to provide a realistic training facility.

By far the largest of the Navy's "proof-of-principle" projects was the Large Ship Reactor (LSR). Following the successful development of nuclear propulsion for submarines, engineers devoted more attention to surface ship applications.

By September of 1954, Navy brass and AEC officials (prodded relentlessly by then-Captain Hyman G. Rickover) were convinced that nuclear propulsion was feasible, and authorized design of an "engine room section of a large surface ship".



Powered by two of the largest reactors then in development (but still unproven), a single shaft output of some 70,000 SHP was specified. This arrangement was obviously intended to represent the nuclear powered equivalent of the enormous energy generated by one-fourth of a conventional FORRESTAL-Class carrier's propulsion plant complex.

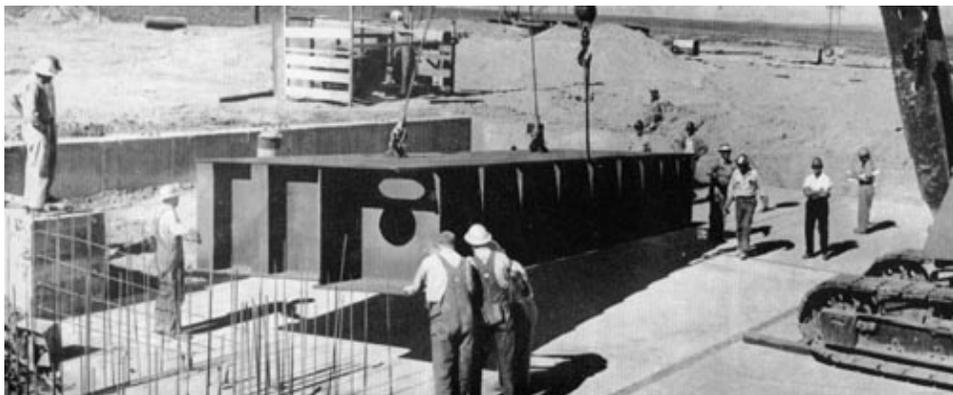
Like the NAUTILUS Prototype (S1W) and numerous AEC experimental reactors, the LSR Project was built at the NRTS on the high desert plains of Idaho. LSR was also officially known as “prototype-ship-on-land” and technically designated as A1W (denoting the first model of aircraft carrier reactor, of Westinghouse design). A1W was the official title most frequently used in correspondence. But to the relatively few people who knew about the project then, “Ship in the Desert” quickly became the most common nickname; as did referring to ‘her’ in the feminine gender.

Design studies by Westinghouse and Newport News Shipbuilding progressed quickly, and by October of 1955, construction of A1W was authorized at an estimated cost of \$26 million. Repeating the very successful practice pioneered during submarine reactor development, the much larger, dual reactor prototype was required to faithfully replicate actual shipboard conditions.

These stringent criteria offered three significant advantages: (1) no major changes for ship application would be necessary following successful prototype operation, (2) construction of the first nuclear powered aircraft carrier could be initiated well in advance of prototype completion, and (3) the prototype could then be utilized for the practical training and qualification of personnel.

To help ensure success and satisfy tight schedules, a full-scale, wooden mock-up of an entire reactor compartment was built in a Newport News warehouse. Using this unorthodox design tool, shipyard designers and engineers studied changes, made improvements and eliminated physical interferences while waterfront personnel simultaneously planned the manufacture of large subassemblies.

Prefabricated under controlled shipyard conditions, the largest units that could be shipped by rail were transported over two thousand miles for field installation. The “keel” section for A1W (a double bottom sub-assembly prefabricated at NNS) was put into place with scant ceremony in June of 1956.



The external, industrial building-like structure of A1W was built conventionally by a Salt Lake City contractor, but all internal features reproduced actual power plant conditions, right down to the smallest detail. Even the label plates were exactly like those that would normally be found onboard a naval vessel. All of the equipment, built to shipboard specifications, was fully operational as well.

To ensure accomplishment of this unusual and fast-paced task, NNS created the Eastern Idaho Construction Company, sending 100 of its brightest engineers and best craftsmen to live and work in Idaho for upwards of three and a half years. At least 20%, perhaps more of this shipbuilder contingent were graduates of the shipyard's Apprentice School.

Most, if not all of the shipbuilders that went to Idaho were handpicked because of their individual skills. NNS personnel had to endure harsh Idaho winters, 130-mile round trip bus rides each working day and they had to literally invent ways to deal with the many technical and logistical differences encountered while building a ship in the desert.



One such individual, who is largely typical of graduate apprentices that participated in the A1W project, **Pete Squires** (1953 – Coppersmith) vividly remembers that unique experience.

“I was called into the copper shop foreman’s office at the shipyard one day, and informed that I had been requested, by name, to go to Idaho and work at A1W. I didn’t know back then what an “A1W” was. Instructed to think the opportunity over, I was also told to make my decision by the y next morning! After talking it over with my wife, we decided to go. Shortly thereafter, following about five days on the road cooped up in our car with a small daughter, we arrived in Idaho Falls.

“After finding an apartment to rent, which was no small accomplishment, I reported to work. I quickly learned that we had to interface with the local construction trades, mostly steel workers. They had fit up a lot of piping before I got there, but didn’t know how to sil-braze copper or CU-NI piping. Any differences in experience quickly disappeared as we worked long hours together to get piping systems completed and ready for test.

“But there were also differences in ‘construction culture’. Unlike the shipyard in the 50s, Idaho construction workers were accustomed to having candy and drink machines on site, and cleaning up well before the end of their shift. An attempt was made to enforce traditional shipyard discipline.

“One day, a steel worker caught quitting early was fired. I didn’t know about that until late in the evening, when I got a telephone call at home telling me not to report to work the next day. The reason given: ‘The steel workers are going fishing’. But the next morning, I got another call, telling me to come to work because ‘The fish are not biting’.

“I later learned that the union representative had told site management that the steel workers were going fishing, and would not be back until the fired individual was rehired. He was rehired that very night, which is why I got those two funny telephone calls.

“Towards the end of my two years of site work, I was encouraged to take some navy health physics courses (at night and on my own time). I did, and that changed my entire career path. When we returned to Newport News, I became one of the first employees in the yard’s brand-new Radiological Control Department. Before my career at NNS ended, I became head of that department.”



Local hiring swelled the project's field team to a peak manning level of over 500. The "locals" had to learn shipbuilding techniques and jargon, and cope with Navy security and stringent nuclear restrictions. Near the completion of the project, the shipbuilders of Newport News proudly gathered outside the facility for a group photograph.



A1W had some decidedly unusual features. For example, the prototype's 70,000 SHP of mechanical energy had to be absorbed by creating a huge shaft-braking device so that no deviation from shipboard conditions would exist inside the "hull". Simulated catapult operations required the use of a thermal energy absorber (a surplus ESSEX-Class main condenser was installed adjacent to A1W).

There were also some embarrassments. When testing commenced, veteran shipbuilders were somewhat chagrined to relearn a basic physics lesson. Gages purchased for "shipboard use" and shop-set for sea level were inaccurate at A1W's elevated location and had to be hastily recalibrated.



Preliminary testing was advanced enough by October of 1958 to permit the first reactor to be taken critical. Initial criticality was again experienced at A1W in July of 1959, with full power operation of the entire facility realized by mid-September, 1959. Shortly after that milestone event, the Chairman of the AEC briefly took control under the ever-watchful eye of Admiral Rickover.

Assisting in the evaluation of the plant's performance were a few Newport News nuclear pioneers. Their leader was **Felix Bledsoe**, Chief Test Engineer (and Honorary Apprentice Alumnus, 1980). **George Grimsley**, Assistant Foreman of Electricians (and 1938 Electrician Apprentice Graduate) and **Ernie McDermon**, Assistant Foreman of Machinery Installation (and 1947 Machinist Apprentice Graduate) were also there to insure that what they had built was tested and operated properly.

Felix, George and Ernie not only worked together, they even sat together when the group photo of NNS employees at the site was taken.



Lessons learned in design and construction, and later in testing and initial operations were quickly applied to the ENTERPRISE reactor plants; designated as A2W and already under construction at Newport News. Big E's keel was laid well before the first A1W initial criticality, and the ship was christened just one year after prototype full power operation commenced.

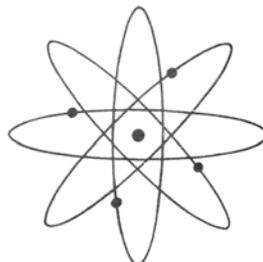
This extensive overlap in prototype and lead ship schedules mirrored the S1W-NAUTILUS successful, but then-radical practice of providing barely enough time between schedules to physically factor in desired design changes. As a result, ENTERPRISE was completed in 1961; years sooner than would have been possible if a more conventional series-style sequence had been applied.

The Ship in the Desert then became primarily a training facility, providing a hands-on shipboard machinery space environment for thousands of aspiring Navy Nuc's. The first trainees were the engineering precom unit for ENTERPRISE, plus a cadre of the shipyard's own engineers. Together, they helped ensure that testing and start-up of CVN-65's eight-reactor complex would be safely accomplished. Over ensuing years, A1W was modified several times by additional transplanted shipbuilders to proof-test advanced concepts and to provide the latest in naval reactor technology for training purposes.

Countless crews were exposed to the monastic regime of the A1W Training Facility for over three decades. Typically, they studied post-graduate level technical subjects at an accelerated pace, passed hours-long written examinations (never ones of the T/F or multiple choice variety) and were subjected to grilling Examining Board orals. In between such activities, they stood watch throughout the prototype and responded to normal operational evolutions, drills and emergencies; most simulated, but some real. This all took place within the crowded confines of a full scale, high-powered reactor plant complex with all of its dynamic and demanding response characteristics.

Despite very high standards and the challenging conditions at A1W, approximately 80% of all trainees at A1W became nuclear qualified. The remaining 20% suffered the ignoble and career-restricting stigma of becoming "disenrolled" from the navy's nuclear program.

After providing training for 36 years, often to aspiring Navy Nuc's far younger than herself, the Ship in the Desert was finally shutdown for good in 1994. A1W steamed hundreds of thousands of theoretical miles without actually going anywhere. But her highly disciplined training practices have been solidly ingrained in the professional work habits of generations of engineers. And her spirit will undoubtedly long live on through their good works, contributing to the safe operation of naval and commercial nuclear reactors well into the 21st century.



AIW

*She never got to launch a plane
Nor even had a ship-like name
But served the Navy all the same
Prototype for nuclear carriers' fame*

*From fleet and college they all came
Scores of youngsters anxious to train
To learn her secrets - and to tame
AIW; a "fissionary" land-locked dame!*

~ Postscript ~

A complete listing of Apprentice School graduates who participated in the construction of AIW was never made public, to the best of my knowledge. However, utilizing the group photo taken in Idaho, I can recognize the following individuals (in addition to Pete Squires, Felix Bledsoe, George Grimsley and Ernie McDermon):

John Landis (1953 – Designer, Hull), **Vernon Casson** (1939 – Plumber), **Jack Watson** (1944 – Pipefitter), **Red Matthews** (1950 – Electricians), **Joe Roudabush** (1954 – Machinist), **Alec Price** (1944 – Machinist), **Jack Girton** (1954 – Machinist), **Gene Corson** (1953 – Machinist), **Phil Weddle** (1952 – Sheet Metal Worker), **Carl Spain** (1944 – Electricians) and **Lonnie Jennings** (1952 – Electricians).

I am quite sure more of the shipbuilders in that group photo were apprentice graduates; it's just that I cannot positively identify them.

Identifiable by me or not, I applaud their pioneering efforts, and further acknowledge their many additional contributions to the construction of ENTERPRISE and numerous other NNS-built nuclear-powered vessels that followed.

I also applaud the efforts of the group in Newport News that created the detailed design for AIW. Many of them were also apprentice graduates, and in 1956, when I joined their group, all of them provided invaluable practical training to my classmates and me.

Just as it was for Pete Squires, that ship in the desert put me on an entirely different career path than I could have ever envisioned before learning what an "AIW" was.

But that's yet another story...

Bill Lee
June 2008