



Lessons Learned N.S. SAVANNAH Decommissioning

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Nuclear Ship SAVANNAH is:

- ❖ **The World's First Nuclear-Powered Merchant Ship**
- ❖ **A National Historic Landmark of the United States**

(National Park Service, 1991)

- ❖ **An International Historic Mechanical Engineering Landmark**

(American Society of Mechanical Engineers, 1983)

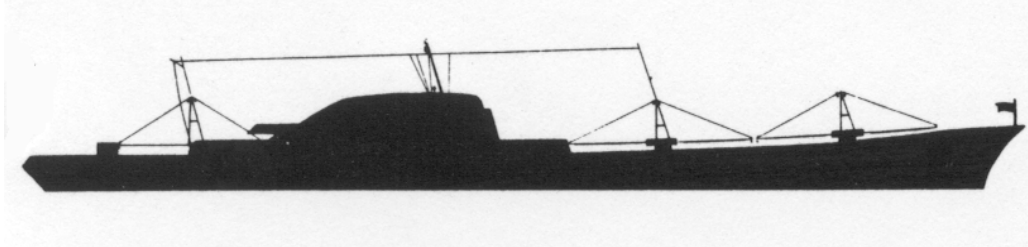
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- ❖ **A Nuclear Engineering Landmark**

(American Nuclear Society, 1991)

- ❖ **Ship of the Year**

(Steamship Historical Society, 2012)

The *Savannah* Project was proposed by President Eisenhower in 1955 as a joint program of the Atomic Energy Commission and the Maritime Administration.



It was authorized by an Act of Congress on July 30, 1956.

The *Savannah* is “a practical merchant vessel of combined passenger and cargo design.”

PL 848 legislative history.

Length Overall	595 ft
Beam	78 ft
Draft	29 ft
Reactor Power	80 MWth
Propulsion Power	22,000 SHP
Speed	21 kts
Passengers	60
Total displacement	22,000 tons
Total deadweight	9,570 tons

The *SAVANNAH* in Context

Proposed 1955

Authorized 1956

Constructed 1958-1962

Operated 1962-1970

- DOE Manhattan Project Sites at Hanford, Oak Ridge, 1943/44-1970
- First nuclear-powered ship: USS *NAUTILUS*, 1955-1980
- First full-scale nuclear generating station: Shippingport, 1957-1982
- First nuclear-powered surface ship: Soviet Icebreaker *LENIN*, 1959-1989
- First nuclear-powered aircraft carrier: USS *ENTERPRISE*, 1962-2015
- Piqua nuclear generating station (AEC Demo), 1963-66

Key Milestones in the Reactor Operating History

- **First Criticality:** December 21, 1961
- **Commissioning:** May 1962
- **Refueling (shuffle):** October 1968
- **Final Shutdown:** November 8, 1970
- **Power History:** 2.423 EFPY
- **Defueling Completion:** September 29, 1971
- **Primary System Wet Lay-up:** October 1971 – January 1973
- **Mothballing Preps:** 1975-1976

Key Milestones in the License History

- **Fueling Authorization:** June 1961
- **Demonstration Ops:** May 1962 – April 1965
- **NS-1 License Issued to FAST:** June 1965
- **License XFR to MARAD:** November 1970
- **Permanent Cessation:** October 1971 (de facto)
- **Possession-Only License:** May 1976
- **Co-Licensing with SC:** 1981-1994
- **License Reversion to MARAD:** July 1994

MARAD's Licensing Position in July 1994

- No dedicated license organization
- One (1) holdover SES nearing retirement as licensee (STA)
- Three former crew (one deck officer, one RO, one SRO)
- No basis documents except the Tech Spec, no procedures, no other programs or processes.
- No budget

NRC expectations – we trust you can take care of the ship (primary safety structure), and will hire competent nuclear staff (contractors) as required.

MARAD's Licensing Position in Feb 2002

(effective decision date to pursue DECON-LT)

- **No dedicated license organization**
- **Former RO as licensee (STA)**
- **One engineer trying to learn**
- **No basis documents except the Tech Spec, no procedures, no other programs or processes.**
- **No budget**
- **Two NOVs that we didn't know how to correct**

MARAD's Licensing Position in Dec 2006

(submittal of PSDAR Rev 0 – we are ready for DECON-LT)

- **Re-established a license organization with clear objectives**
- **That poor engineer is now the licensee (STA)**
- **Core staff of MARAD direct employees supplemented by competent nuclear contractors with operational and decommissioning experience (Saxton, TMI)**
- **Benchmarked other projects; took the Argonne class; joined ANS**
- **Line-item budget for baseline protective storage**
- **Complete overhaul of basis documents and creation of a procedures program in-progress.**

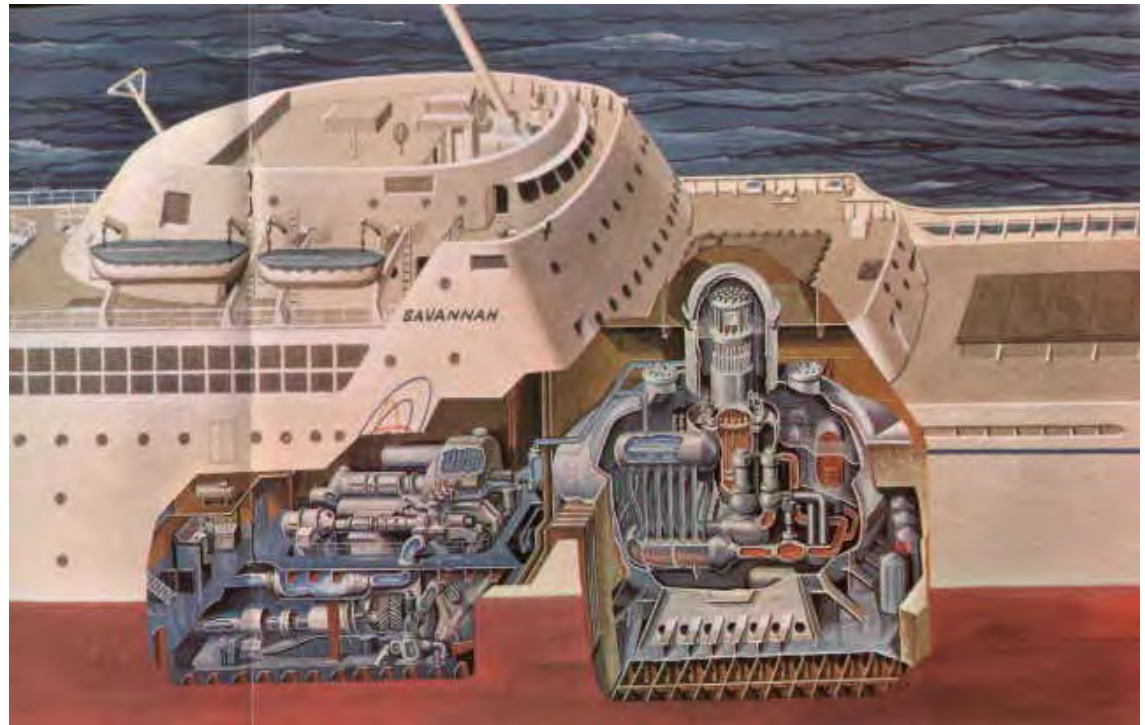
MARAD's Decommissioning Objectives

- Terminate the NRC license without restrictions or conditions
- Release the ship
- Allow the ship to be disposed
 - Preservation (Lease or Donation), Reefing, Scrapping

DECON Scope

Remove systems, structures and components as needed to meet license termination:

- Control Rod Drive System
- Pressurizer
- Reactor Pressure Vessel
- Neutron Shield Tank
- Steam Generators
- Primary System piping
- **Outlying equipment**



Disposal of items in licensed low-level radioactive waste disposal sites.

MARAD's Decommissioning Philosophy

The preferred outcome after decommissioning and license termination is preservation of the ship; consequently:

- Wherever possible, decommissioning activities are undertaken in a manner that fosters future preservation;
- All dismantlement activities will use existing ship accesses to minimize impacts to adjacent structure;
- Whenever an option is presented or evaluated, the path that promotes preservation is given preferential consideration; and,
- Opportunities to improve the ship concurrent with decommissioning are exercised.

Conceptual Approach and Methodology

- **Three Phase Project**
 - (I) DECON Planning and Engineering;
 - (II) Industrial Dismantlement Activity;
 - (III) License Termination
- **Employ mature commercial nuclear decommissioning technologies and practices**
- **Maintain Integrity of Licensed Site and Control of Activities**

Current Status

(January 2025)

- **Funds were appropriated in 2017 / 2018**
- **Phase I completed March 2021**
- **Phase II completed November 2024**
- **LTP Approval expected next week**
- **FSS to complete this month; confirmatory surveys already complete**
- **License Termination anticipated early 2026**

Lessons Learned

(Compared to our pre-project benchmarking)

- *SAVANNAH* / MARAD most closely paralleled NASA / Plum Brook
- A Federal Licensee left with an orphaned legacy facility within an organization whose organic expertise was not nuclear
- A relatively small, low-priority project left to compete within a much larger budget environment
- Significant distrust at OMB to start

Lessons Learned

(Project Specific)

- **Our selected method and approach worked well**
- **Commercial decommissioning services adapted easily to our unique conditions**
- **The extra decade we had gave us plenty of time to work out details, develop proficiency in our programs and processes, and refine our plans**
- **We were fortunate to retain a core cadre of persons for most of the project – continuity cannot be emphasized enough.**

Lessons Learned

(Recapping Plum Brook and comparing to SAVANNAH)

- **Lesson # 1 - Contracting**
 - *The licensee must have privity of contract with the decommissioning contractor*
 - Difficult to reconcile with the Federal Acquisition Regulations, especially given the extensive use of specialty subcontractors
 - Because MARAD's Contracting Officer was part of the benchmarking and planning, we were able to design a contract vehicle in conjunction with procedures and programs to give MARAD a deeper level of privity than might otherwise have been available.

Lessons Learned

(Recapping Plum Brook and comparing to SAVANNAH)

- **Lesson # 2 – Roles and Responsibilities**
 - *Formal roles and responsibilities should be established right up front*
 - After meeting with NRC, MARAD determined to hire contractors vice direct employees for a substantial percentage of the licensee organization
 - The organizational structure was designed as a hybrid, with authorities laid out in the QAP, and embedded directly in the contract SOW

Lessons Learned

(Recapping Plum Brook and comparing to SAVANNAH)

- **Lesson # 3 – Internal Communications**
 - *Have strong open 2-way communication within the project*
 - The organizational structure combined with procedural roles and responsibilities ensured MARAD was fully involved in all project matters, even when a late shift to a fixed price model was adopted for Phases II and III
 - MARAD staff successfully defended a prescriptive “Statement of Work” approach, versus a performance-based service contract model. The performance-based model is irreconcilable with the license – see the NRC enforcement policy vis-à-vis licensee accountability for contractors, subs and vendors

Lessons Learned

(Recapping Plum Brook and comparing to SAVANNAH)

- **Lesson # 4 – External Communications**
 - *Have a proactive, open public outreach effort*
 - We planned for a robust outreach program – until the money showed up. Then all interest evaporated, and we fell way short. SAVANNAH may have been the least transparent decommissioning in the United States to-date. We “got away” with this basically because the facility had no ties to the land or community
 - Despite a less-than-ideal public outreach, the outreach to critical city and state stakeholders in the form of agencies, elected officials, and community organizations was good.

Lessons Learned

(Recapping Plum Brook and comparing to SAVANNAH)

- **Lesson # 5 - Characterization**
 - We did enough. We could have done more, but as it turned out, we had no significant discoveries
- **Lesson # 6 – Offsite Contamination**
 - Our site is isolated from the terrestrial and aquatic environments. There was no operational history of contamination at any long-term storage site, and certainly no offsite contamination during the project execution

Lessons Learned

(Recapping Plum Brook and comparing to SAVANNAH)

- **Lesson # 7 - SAFSTOR**
 - *Special efforts must be planned for and made in the areas of equipment, procedures and retirees*
 - MARAD drew on this experience to engage retirees early in support of the HSA, and other planning
 - Substantial effort was put into developing and maintaining a procedures and processes program, and updating and maintaining fundamental license basis documents
 - Restoration of equipment was challenging, but ultimately satisfactory

Lessons Learned

(Recapping Plum Brook and comparing to SAVANNAH)

- **Lesson # 8 – Waste Streams**
 - *Focus planning on waste stream types, volumes and disposal sites*
 - MARAD was constrained early in the project by the relative lack of disposal site competition – based on the closure of Barnwell to out of compact waste. By the time we received funds, this was much less of an issue
 - MARAD did receive a DOE eligibility determination, but in consultation with DOE and in consideration of the Economy Act, chose to specify the use of a commercial LLRW repository

Lessons Learned

(Recapping Plum Brook and comparing to *SAVANNAH*)

- **Lesson # 9 – Planning the End Game**
 - MARAD's end game was already defined by statute – dispose the ship either by donation, reefing or scrapping. The ship's 1991 designation as a National Historic Landmark introduced the preservation wrinkle – minimize harm! We actually found that this comported well with DECON, when taking all other factors into consideration. MARAD is actively seeking a preservation outcome while being prepared for the alternatives.
- **Lesson # 10 – Have Fun !**
 - Obviously !!

One More Lesson Learned

- **The NRC definition of a Federal Licensee is not quite adequate**
 - NRC defines a federal licensee as one whose funding is sourced by appropriations, and who demonstrates financial assurance by the full faith and credit of the United States. NRC expects federal licensees to comply in-full with its regulatory schema.
 - For a federal licensee, the regulatory schema conflicts in numerous places with other statutes and regulations, but NRC has no mechanism to consider the circumstances of a federal licensee stuck between two or more rocks
 - Without compromising safety, NRC should consider adding provisions to its internal procedures to acknowledge that federal licensees are not, and cannot be equivalent to commercial or municipal organizations.



May 16, 2024

Questions?

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Additional Info:

<https://www.maritime.dot.gov/outreach/history/ns-savannah-decommissioning-and-disposition>

<https://www.regulations.gov/docket/MARAD-2020-0133>