


Nuclear Ship *Savannah*
Public Information Meeting
Canton (Baltimore), Maryland
July 9, 2008

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MARAD
U.S. MARITIME ADMINISTRATION


N. S. SAVANNAH
WORLD'S FIRST NUCLEAR
POWERED MERCHANT SHIP
MARITIME DAY
VISITS
BALTIMORE, MD.

N.S. *Savannah* at Canton Marine Terminal

MARAD

Presentation Outline

MARAD

- Introduction
- The Maritime Administration
- Overview of the N.S. *Savannah* Program
- Decommissioning
- Baltimore Layberthing and SAFSTOR
- Future Plans
- Conclusion
- Questions

Savannah Technical Staff

"The McCready Shield"

By John Spears, 2005

From an original sketch by RADM Lauren S. McCready, USMS, 1965

About The Maritime Administration

MARAD

- An agency of the U.S. Department of Transportation, MARAD promotes the development and maintenance of an adequate, well-balanced United States merchant marine, sufficient to carry the Nation's domestic waterborne commerce and a substantial portion of its waterborne foreign commerce, and capable of serving as a naval and military auxiliary in time of war or national emergency.
- MARAD traces its ancestry to the United States Shipping Board, created in 1916 under the auspices of the Shipping Act.
- MARAD has constructed, owned, operated and maintained merchant ships since its inception.

About The Maritime Administration

MARAD

- As the United States Maritime Commission, our agency managed the greatest ship construction program ever undertaken. Over 5,000 ships were constructed and operated by the USMC between 1941 and 1945.

- The present-day Maritime Administration resulted from a reorganization of the USMC in 1950; originally part of the Department of Commerce, MARAD was transferred to the Department of Transportation (DOT) in 1981.

Savannah Technical Staff

- The STS is the MARAD organizational unit that manages the N.S. *Savannah*, and serves as the licensee organization. It was re-established in 2005.
- From 1976 – 2005, the license was managed on a collateral basis, using residual program staff and resources.
- Present-day STS is based on historical models from the 1956 – 1976 timeframe.
- STS draws on in-house expertise, contractor staff, and partnerships with external organizations including Dept of Energy's Argonne Nat'l Lab and DOT's Volpe Center.

President Dwight Eisenhower addressed the United Nations in 1953; proposing a program for peaceful uses of atomic energy.

N.S. *Savannah* was the centerpiece of the program that grew from that speech and became known as …

"Atoms for Peace"

The N.S. *Savannah* Program

was a joint project of the

Maritime Administration and

the Atomic Energy Commission.

It was authorized by an Act of Congress, PL 848,

on July 30, 1956.

The core objectives of the N.S. *Savannah* program were:

- **to demonstrate to the world the peaceful use of atomic power**
- **to demonstrate the feasibility of nuclear-powered merchant ships**
- **to establish international recognition and acceptance of peaceful nuclear power**
- **to establish an infrastructure in the marine industry to support operations by nuclear powered merchant ships**

Savannah's **history can be divided into four distinct periods:**

1. Construction and Operation (1956 – 1970)
2. Defueling and Deactivation (1971 – 1980)
3. Museum Service (1981 – 1994)
4. Government Retention (to present)

Overview - Construction and Operations

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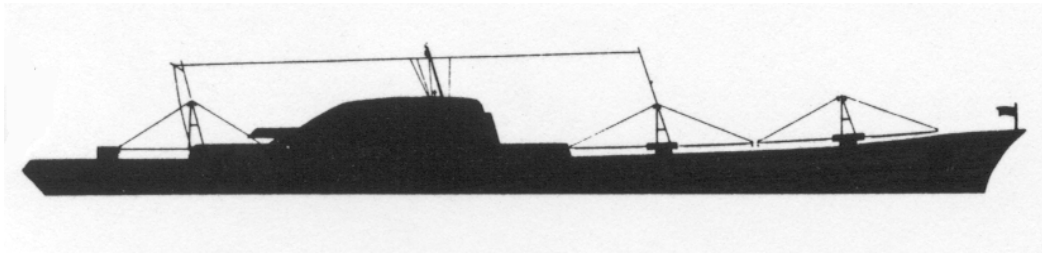

The *Savannah* is "a practical merchant vessel of combined passenger and cargo design." *PL 848 legislative history.*

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**

MARAD contracted for construction of the ship and directed ship operations.

***Savannah* was constructed by the New York Shipbuilding Corp., in Camden, New Jersey**

AEC contracted for the nuclear power plant and provided initial crew and reactor operator training.

***Savannah's* nuclear power plant was supplied by the Babcock & Wilcox Co., of Lynchburg, Virginia**

Overview - Construction and Operations

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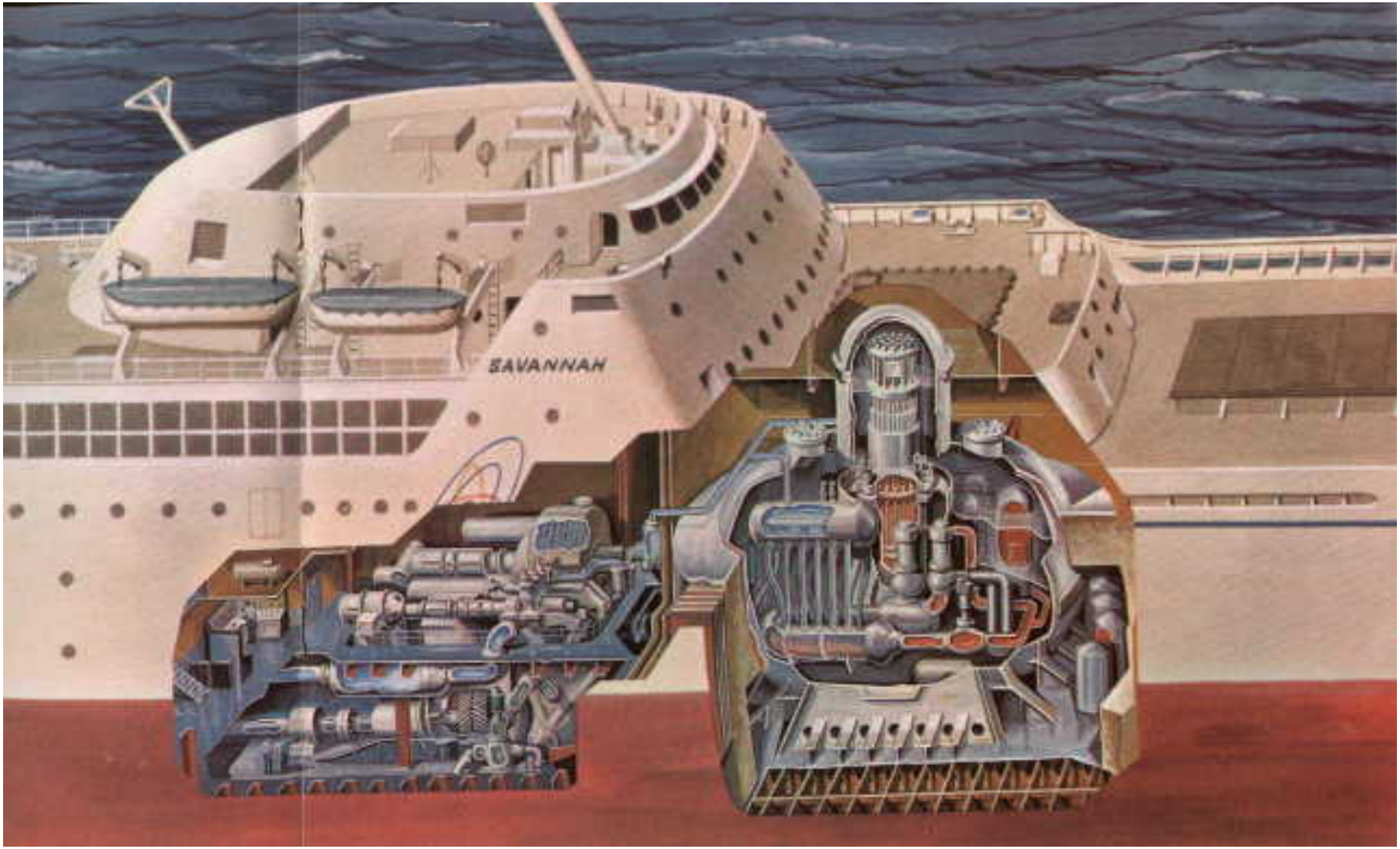

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Key Dates in *Savannah's* Construction
Keel Laying, National Maritime Day, May 22, 1958
Launching, July 21, 1959 (sponsored by Mamie Eisenhower)
Initial Reactor Criticality, December 21, 1961
Builders Tests and Sea Trials, Yorktown, VA May 1962

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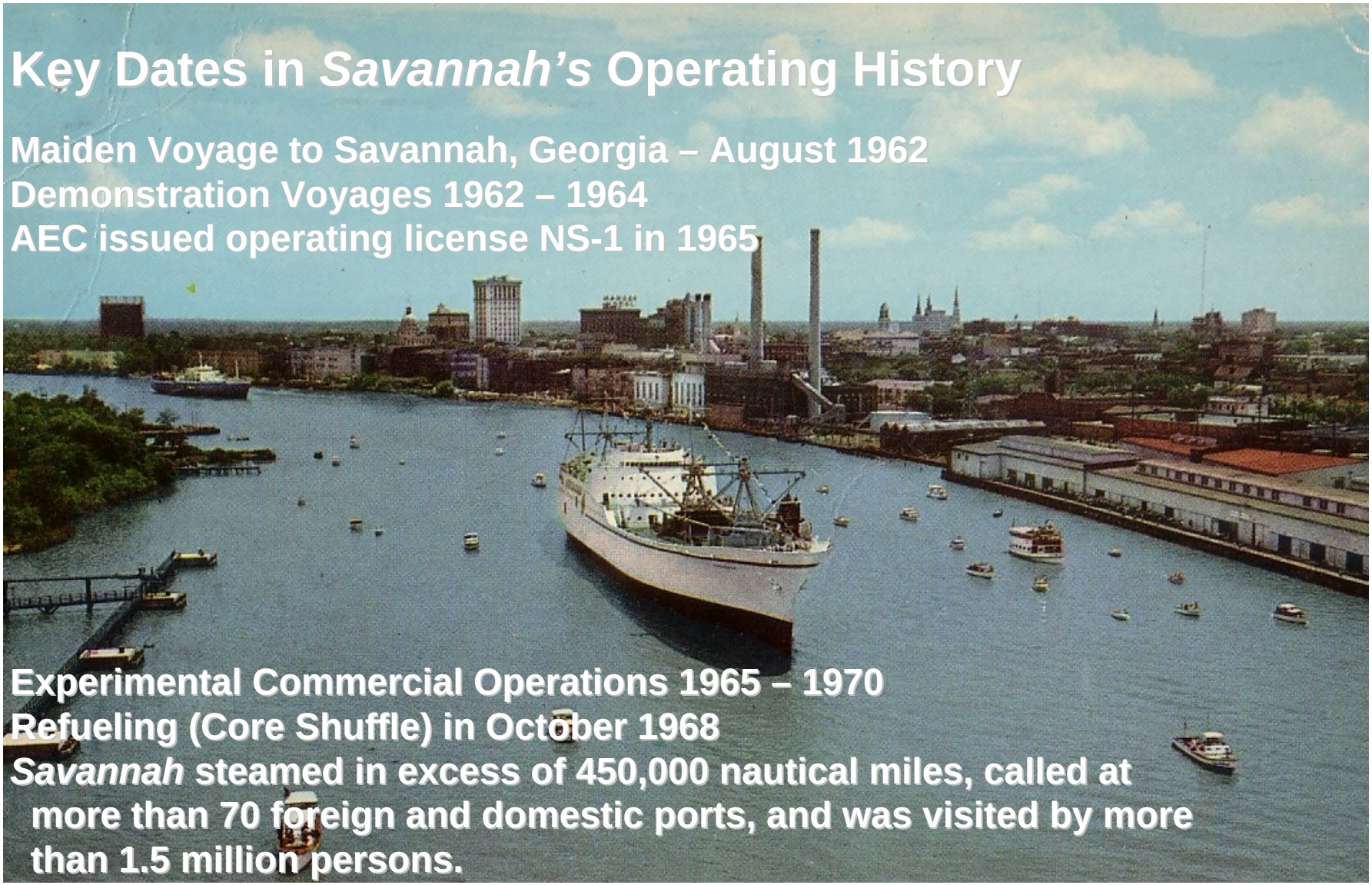

Key Dates in *Savannah's* Operating History

Maiden Voyage to Savannah, Georgia – August 1962
Demonstration Voyages 1962 – 1964
AEC issued operating license NS-1 in 1965

Experimental Commercial Operations 1965 – 1970
Refueling (Core Shuffle) in October 1968
***Savannah* steamed in excess of 450,000 nautical miles, called at more than 70 foreign and domestic ports, and was visited by more than 1.5 million persons.**

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Was the N.S. *Savannah* program successful?

- to demonstrate to the world the peaceful use of atomic power - ACCOMPLISHED
- to demonstrate the feasibility of nuclear-powered merchant ships - ACCOMPLISHED
- to establish international recognition and acceptance of peaceful nuclear power - ACCOMPLISHED
- to establish an infrastructure in the marine industry to support operations by nuclear powered merchant ships ACCOMPLISHED

With all of its program objectives successfully completed, the Maritime Administration removed the *Savannah* from service in the summer of 1970 and placed it into layup in Galveston.

- **Financial pressures due to the Vietnam War and MARAD's implementation of the Merchant Marine Act of 1970 programs led to the decision to layup the ship in 1971.**
  - A retention crew was retained, and the plant was maintained in a condition to allow reactivation,
  - The ship was drydocked in October/November 1970,
  - Planning continued for a voyage to Japan in 1971.

Defueling and Layup: 1970 – 1973

- **Final Commercial Voyage ended in July 1970; ship returned to Galveston. AEC license was transferred from FAST to MARAD; AEIL retained as General Agent.**
  - Last two ports prior to layup were Baltimore and Norfolk!
- **Last voyages under power; October / November 1970 for drydocking. FWE November 9, 1970.**
- **Core 1a Removed at Galveston Fall 1971; primary systems maintained in wet-layup status (capable of future refueling). Ship towed to Savannah, GA in January 1972.**

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Defueling and Layup: 1970 – 1973

- The City of Savannah Georgia hoped to obtain the *Savannah* for use as the *Eisenhower Peace Memorial*
- While the ship lay at Savannah, management of the nuclear facility was exercised by the MARAD Savannah Technical Staff with contractor support (Todd Nuclear Division).
- Studies for refueling and alternative use continued while Savannah, GA studied use of the ship as a memorial.
- Final decision to permanently retire the ship (i.e., no future refueling) was made in January 1973. MARAD prepared to either title transfer the ship, or move it to a reserve fleet for indefinite retention.

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Mothballing: 1974 – 1976 and Limbo: 1976 - 1980

- After the Savannah, GA effort failed, the ship was moved to North Charleston, SC for initial decommissioning work, and preparation for reserve fleet lay-up.
- Initial mothballing was completed in 1975; ship was drydocked in Baltimore; NRC operating license was amended in 1976 to possession-only.
- Interest from SC brought the ship back to North Charleston after drydocking.
- Beginning in 1975, MARAD STS was disbanded; license management was exercised without a formal organization.

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Patriots Point: 1981 – 1994

- Legislation passed in1980 authorized MARAD to bareboat charter the *Savannah* to the State of SC. The initial charter was signed in 1981 with 5 year term; renewable for 5-year intervals.
- MARAD maintained ownership of the vessel and future liability for decommissioning / disposal of the nuclear power plant. SC PPDA had full use of the ship, and managed radiological surveillance, monitoring and protection.
- *Savannah* opened to the public at Patriots Point in late 1981.
- Vessel was open for self-guided tours. Plans to use the ship as a hotel, conference center and restaurant were not realized.

Patriots Point: 1981 – 1994

- Management of license was significantly changed. SC PPDA was added to the NRC license as a "co-licensee" and all radiological and ship-husbandry matters were handled by the state. MARAD involvement with the ship was very limited.
- The ship remained under-utilized throughout most of its time at PPDA. After Hurricane Hugo (1989), PPDA sought to return the ship in 1991, but elected to renew the charter instead.
- In late 1992 the ship developed a leak in cargo hold 6. This prompted action by MARAD to fund a drydocking, which remained its responsibility under the charter.
- PPDA exercised its option to terminate the charter effective with MARAD removal of the ship for drydocking, May 1994.

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James River: 1994 - 2002

- *Savannah* was drydocked in Baltimore, June-July 1994. Topside repairs were made to seal deck drains and other water leaks. U/W hull was found extensively pitted; weld repairs were made, and hull blanks tested. DH installed.
- Ship was towed to the James River fleet and nested with the STURGIS; the US Army Corps nuclear power barge.
- License was amended to remove SC; *Savannah* reverted to sole MARAD control. License management was now vested in few remaining experienced staff, on collateral basis.
- The ship was expected to remain in the fleet 30-40 years.

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James River: 1994 – 2002

- 1996; Navy published EIS on submarine / cruiser decommissioning; MARAD explored *Savannah* decomm.
- 1998; last R&D personnel with *Savannah* experience retired; license management passed to Office of Ship Operations.
- 2001; MARAD receives two cited license violations related to management of radiological protection. Commercial interest in decommissioning *Savannah* is expressed.
- Post 9-11 MARAD studied vulnerability of the facility; Feb 2002 Maritime Administrator approved moving forward with decommissioning.

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Resurgence: 2002 - 2005

- Initial activities included correcting the license violations.
- A planning contract was awarded and preliminary decommissioning studies conducted. Meetings held with NRC to discuss decommissioning plans.
- Radiological and environmental characterization surveys were conducted; included destructive sampling of the reactor pressure vessel.
- Budget established and appropriations sub-line created in Ship Disposal account.
- 2004: Last HQ employee with direct *Savannah* operating experience retires.

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Challenges - 2002 to 2005

- The NS-1 license was effectively dormant after 1976; the *Savannah* existed in a “time warp” from that date onwards.
- MARAD’s licensing competency gradually diminished from 1976 – 2003.
- NRC requirements evolved over time, but MARAD did not keep-up with these developments.
- MARAD needed to re-establish its licensing competency in order to effectively manage the *Savannah* nuclear facilities, and move on towards decommissioning.

Challenges - 2002 to 2005

- MARAD began that process in 2003 with pre-decommissioning planning contracts, and continued with rigorous self-assessment activities and “dragging the license into the present-day”
- Contemporary Environmental and Radiological programs and processes that are precursors of current or traditional power reactor decommissioning models were not current.
- MARAD re-established the *Savannah* Technical Staff as an organization to manage both the decommissioning program and the routine licensing functions.

MARAD

Decommissioning: 2005 - Present

- **The New *Savannah* Technical Staff provides a competent licensee organization sufficient to manage contractor activities associated with pre-decommissioning and decommissioning activities.**
  - Competencies include conventional ship husbandry, industrial safety & health, nuclear quality assurance and licensing compliance
- **MARAD's contemporary licensing framework is being developed and implemented.**
  - QA Plan, PSDAR, Updated Final Safety Analysis Report are among contemporary documents prepared and submitted to NRC.

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What is Decommissioning?

- Decommissioning of nuclear facilities is defined and regulated by the Nuclear Regulatory Commission.
- It involves safely removing a facility from service, reducing residual radioactivity, dismantling and disposing of plant components and equipment, and protecting the public and the environment.
- The end result (for *Savannah*) is termination of the facility license.

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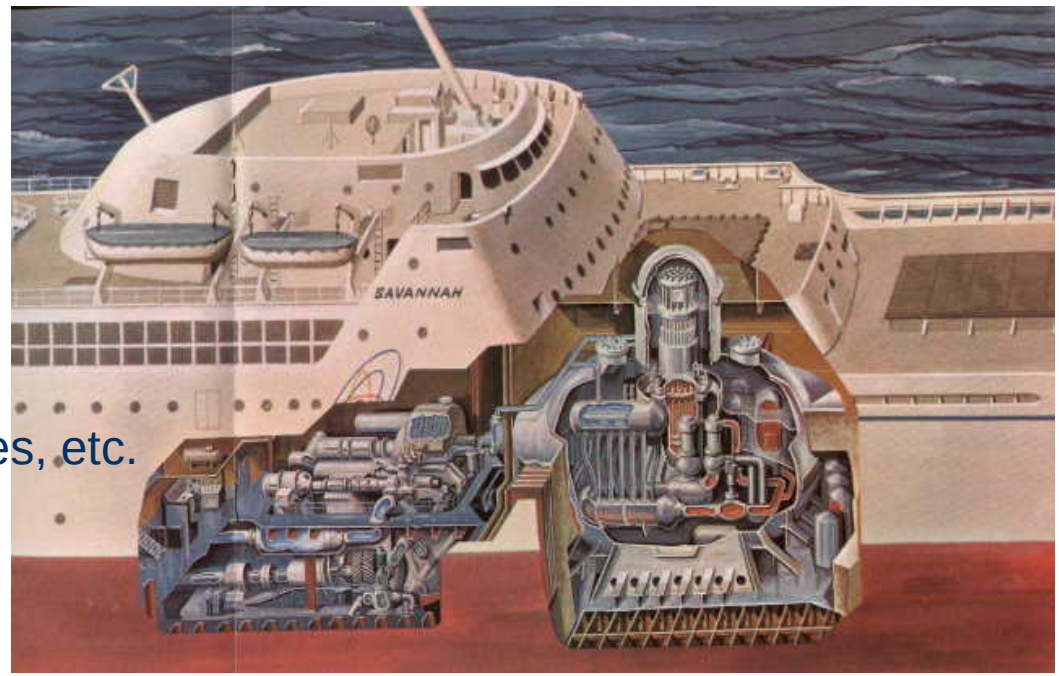
What is Decommissioning?

- **The NRC allows three methods for decommissioning.**
  - ENTOMB – is a specialized method designed for highly contaminated facilities that must be isolated from the environment for a long period of time.
  - DECON – is the immediate dismantling, remediation and disposal of plant components, equipment and structures that contain radioactive contaminants, and terminating the license.
  - SAFSTOR – is a process that places a facility in secure long term (up to 60 years) storage until DECON is completed.

What needs to be done to the *Savannah*?

Removal of all remaining systems, structures and components associated with the nuclear power plant, including:

- Reactor Pressure Vessel
- Control Rod Drive System
- Neutron Shield Tank
- Steam Generators
- Pressurizer
- Primary System piping, valves, etc.



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

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What do we know?

- MARAD completed radiological and environmental characterization surveys (sampling & analysis) of the nuclear and non-nuclear sections of the ship in April 2005
- Additional sampling and analysis of the Reactor Pressure Vessel was completed in November 2005.
- RPV was found to be Class A (low level) radioactive waste.
- The plant is radiologically stable, with lower levels of residual contamination and radioactivity than predicted when initial project planning began in 2003.

Decommissioning

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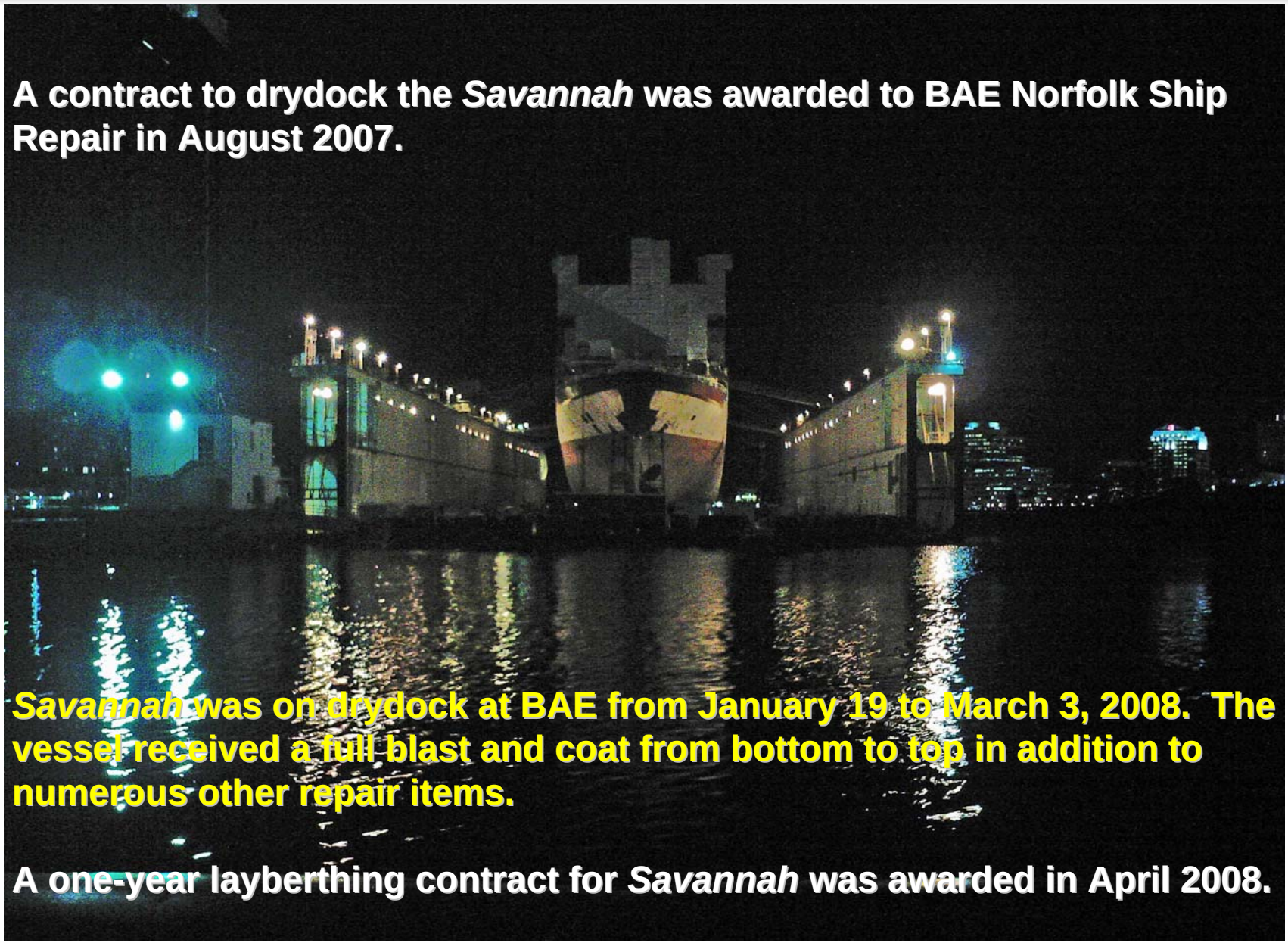
To support future decommissioning activities, MARAD awarded a contract to Colonna's Shipyard, Norfolk, VA for topside repairs and interior cleaning.

***Savannah* was towed from the JRRF to Colonna's on August 15, 2006.**

***Savannah* was layberthed in Hampton Roads throughout 2007.**

N.S. *Savannah* alongside *John W. Brown*, Colonna's SY

Decommissioning



A contract to drydock the *Savannah* was awarded to BAE Norfolk Ship Repair in August 2007.

Savannah was on drydock at BAE from January 19 to March 3, 2008. The vessel received a full blast and coat from bottom to top in addition to numerous other repair items.

A one-year layberthing contract for *Savannah* was awarded in April 2008.

Decommissioning

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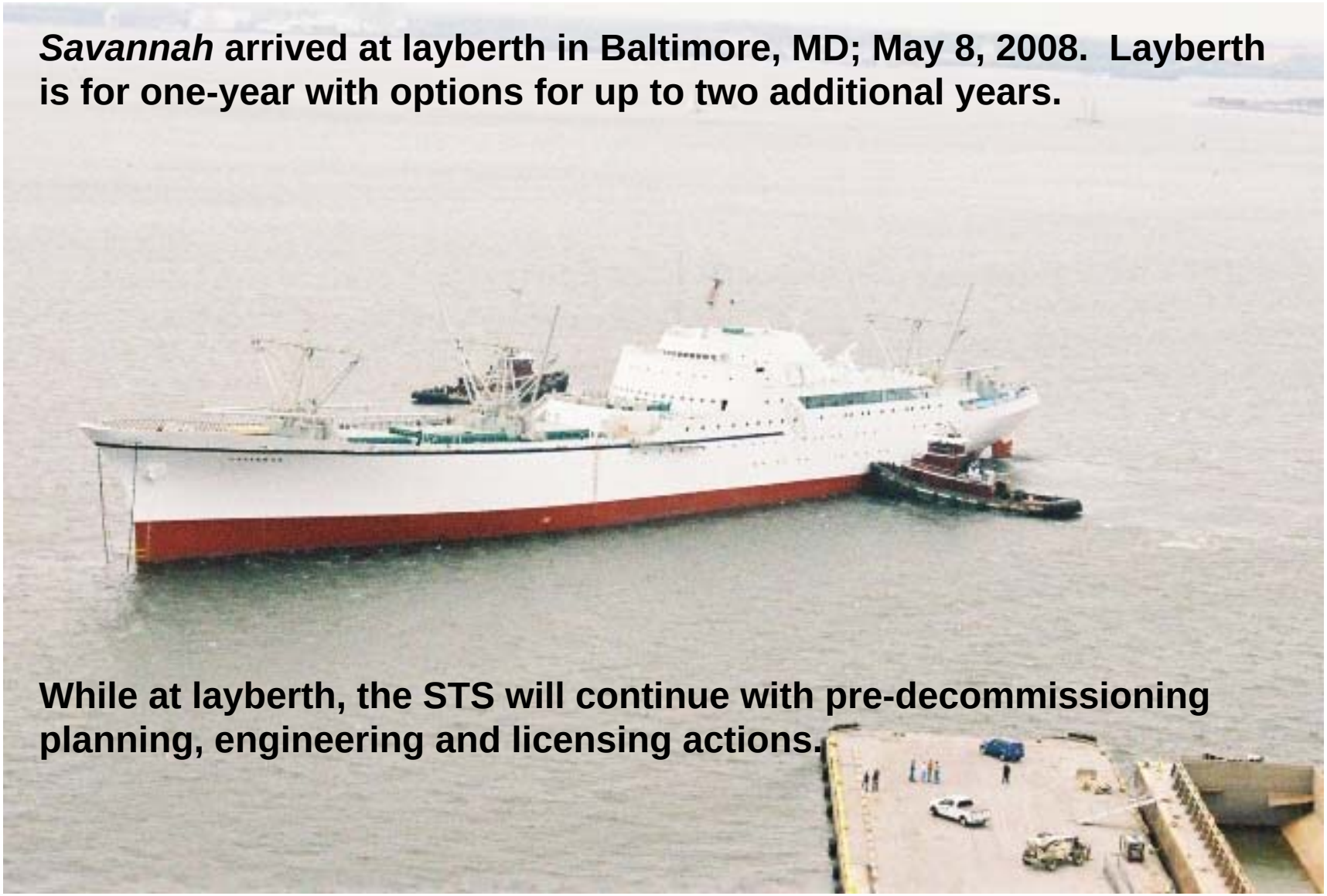
Savannah **arrived at layberth in Baltimore, MD; May 8, 2008. Layberth is for one-year with options for up to two additional years.**



While at layberth, the STS will continue with pre-decommissioning planning, engineering and licensing actions.

When will it be done?

- **NRC Regulations require decommissioning within 60 years of cessation of operation; for *Savannah* this is 2031. But …**
  - Mature commercial decommissioning experience exists today.
  - 1st generation of experienced reactor designers and operators have retired; potential loss of corporate knowledge and experience that MARAD requires for *Savannah.*
- **However …**
  - Federal Budget constraints make funding decommissioning now difficult.
- **MARAD is reevaluating all options, including deferring decommissioning to 2031.**

Decommissioning Environmental Assessment

- MARAD prepared a draft EA in 2006, and published a final EA in 2008.
- The Proposed Action is to decommission the *Savannah*.
- The Finding of No Significant Impact (FONSI) did not make a selection among the alternatives; however,
- MARAD's FY 2009 Budget Request is based on implementing the SAFSTOR alternative.
- Implementing a SAFSTOR program now is substantially a pre-requisite to DECON, and does not preclude a shift to DECON during the next Administration.

What will be done in Baltimore?

- Continued development of the license compliance program; namely, procedure and process preparation, training, and implementation.
- Development of STS proficiencies and competencies.
- Limited and controlled industrial and radiological remediation to bring the Savannah into compliance with SAFSTOR criteria; NO MAJOR DISMANTLEMENT ACTIVITIES ARE PLANNED.
- Detailed decommissioning engineering and planning.
- Ship custody, retention and preservation.

Savannah NRC License Provisions

- **License C.(2) …**
  - **… Shall not dismantle or dispose of the facility without prior approval of the Commission."**

- **Technical Specifications**

- 2.1 Liquid Waste
  - No radioactive liquids will be produced except for (unlikely) decontamination

- 2.2 Airborne Particulate Releases
  - Radioactive airborne particulate releases may occur due to maintenance requirements such as cutting and welding of contaminated components.
  - No activities shall be conducted that would result in a release greater than 10% of limits specified in 10 CFR 20 or other applicable Federal regulations.

2.3 Radioactive Liquid Waste Release Surveillance

- Concentrations of radioactive liquid waste shall not exceed 10% of the applicable limits of 10 CFR 20 or other applicable Federal regulations.

2.4 Solid Radioactive Waste Release

- Applies only to those solid radioactive wastes generated as the result of general decontamination of controlled areas, ship surveillance, and entry into controlled areas.

Baltimore Layberthing and SAFSTOR

MARAD

- **Mothballed is defined in Reg Guide 1.86, Termination of Operating License (1974)**
- **SAFSTOR is defined in Reg Guide 1.185, Standard Format and Content for PSDAR (2000)**

  SAFSTOR added these preparation requirement to

  - 'Must' vs. 'should' remove fluids, fuel and resin
  - Reconfigure ventilation systems and fire protection systems for use during the storage period
  - Develop inspection and monitoring plans during the storage period
  - Establish management and staffing to support all decommissioning periods
  - Develop a Quality Assurance (QA) Plan to support all decommissioning periods
  - Develop a Radiation Protection Plan to support all decommissioning periods
  - Develop a Security Plan to support all decommissioning periods

Baltimore Layberthing and SAFSTOR

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Mothball requirement during Storage	SAFSTOR requirement during Storage
Physical barriers should be inspected at least quarterly to ensure locks are intact and the barriers have not deteriorated. A site representative should be designated to be responsible for controlling access into and movement within the facility.	Maintenance of security systems.
Radiation surveys should be performed to verify that no radioactive material is escaping or being transported past barriers. Environmental radiation surveys should be performed at least semiannually to verify that no significant amounts of radiation have been released to the environment.	Maintenance of radiation effluent and environmental monitoring programs. Processing of any radwaste generated (usually small amounts).

Baltimore Layberthing and SAFSTOR

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Mothball requirement during Storage	SAFSTOR requirement during Storage
No comparable requirement.	Performance of preventative and corrective maintenance on plant systems that will be operating and/or functional during storage.
No comparable requirement.	Maintenance of any systems critical to final dismantlement during the storage period.
No comparable requirement.	Performance of preventative and corrective maintenance on plant systems that will be operating and/or functional during storage.
No comparable requirement.	Maintenance to preserve structural integrity.

Baltimore Layberthing and SAFSTOR

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Mothball requirement during Storage	SAFSTOR requirement during Storage
Administrative procedures should be established for the notification and reporting of abnormal occurrences: 1) entrance by unauthorized individuals into the facility and 2) a significant change in radiation or contamination levels in the facility.	Report events IAW 10 CFR.
Annual report and abnormal occurrence reports should be made.	Make reports IAW 10 CFR.
Records and logs should be established and kept until the license is terminated: ▪Environmental surveys ▪Radiation surveys ▪Inspections of physical barriers ▪Abnormal occurrences	Keep records IAW QA plan and 10 CFR.

Baltimore Layberthing and SAFSTOR

MARAD

Our most important activity at Baltimore is a …

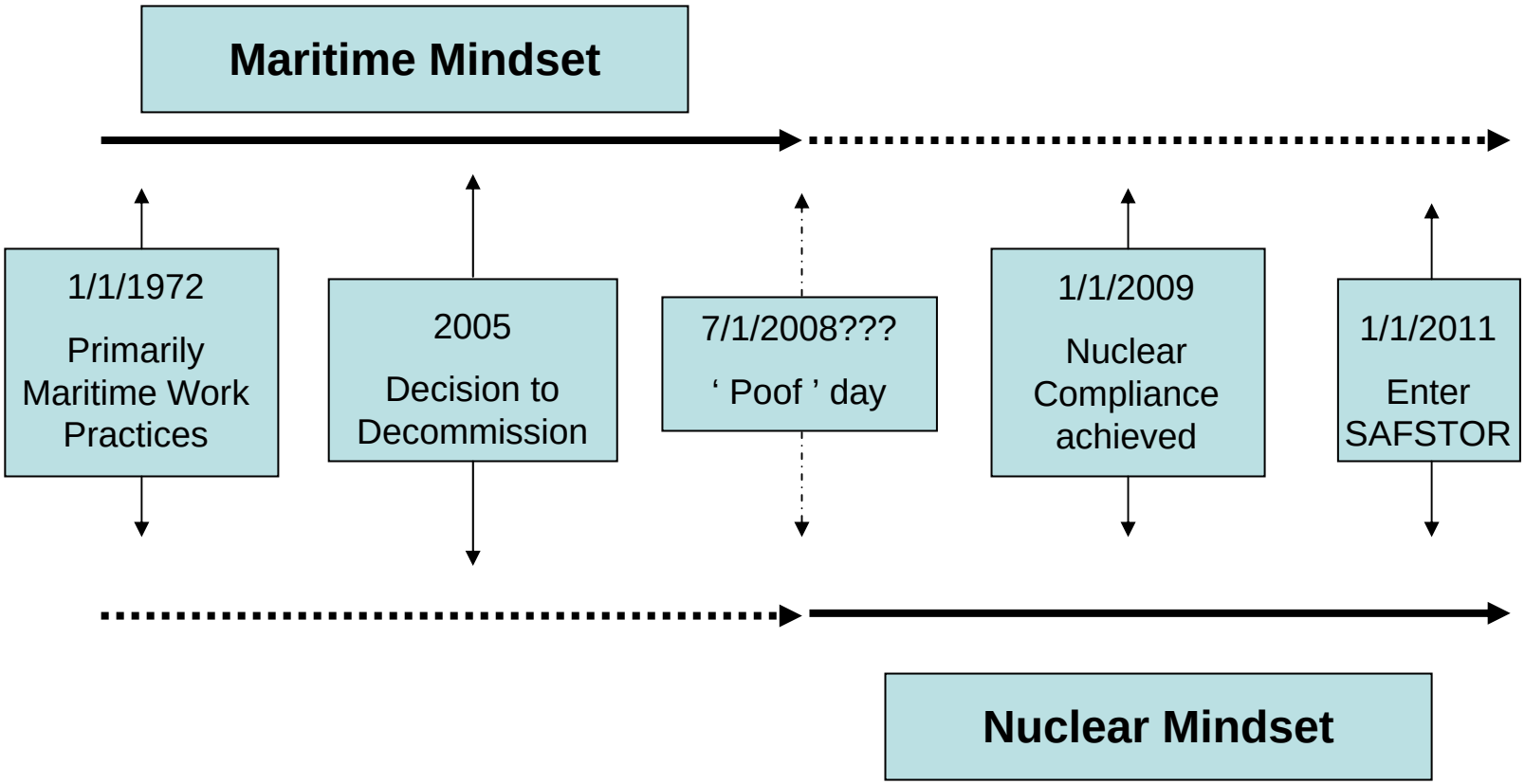
Shift of Mindset

Wherein *Savannah* transforms from a

“ship with a nuclear reactor” to a

“nuclear facility that happens to be on a ship.”

Baltimore Layberthing and SAFSTOR



Baltimore Layberthing and SAFSTOR

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The Savannah SAFSTOR program is defined by a technical scope of activities.

When these activities are completed, the ship will be placed into a long-term retention site.

This retention site, and the activities allowed on the ship need not be limited to a reserve fleet and complete inactivity.

N.S. *Savannah* Future

MARAD

"Savannah" i Helsingborg i september 1964. © Jan Lindahl.

The Nuclear Ship *Savannah* is:

- **A National Historic Landmark of the United States**

  (National Park Service, 1991)

- **An International Historic Mechanical Engineering Landmark**

  (American Society of Mechanical Engineers, 1983)

- **A Nuclear Engineering Landmark**

  (American Nuclear Society, 1991)

Preservation of the *Savannah*

- **Preservation of the *Savannah* is consistent with the President's "Preserve America" Initiative.**
- **Preserve America (E.O. 13287, March 3, 2003) calls for Federal Agencies to take a leadership role in preserving America's heritage.**
- **Goal Number 1 of the initiative is**
  - ***To Preserve America's heritage by actively advancing the protection, enhancement, and contemporary use of the historic properties and resources owned by the Federal Government.***

***Savannah* is unique.**

Savannah is arguably among the most significant ships ever built.

Savannah is arguably among the most beautiful ships ever built.

Savannah had an inherently public purpose, and can still perform her mission to educate the world about maritime and nuclear issues.

Preserving Savannah is the right thing to do.

Conclusion

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For More Information …

MARAD

- Email us at Savannah@dot.gov

- The *Savannah* Decommissioning Project website can be accessed from www.marad.dot.gov

- Procurement information related to the *Savannah* Decommissioning can be found on MARAD's Virtual Office of Acquisition website at:

  https://voa.marad.dot.gov

  Click on "Programs" and then "NS Savannah"

- The Nuclear Regulatory Commission website is www.nrc.gov and contains information and points of contact for decommissioning questions, and public record documents pertaining to the *Savannah* license

  (License NS-1, Docket No. 50-238)

Questions

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N.S. *Savannah*; Atoms for Peace

N.S. *Savannah*, 1964

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N.S. *Savannah* in Savannah GA, 1972

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N.S. *Savannah* at Patriots Point

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N.S. *Savannah* on drydock, 1994

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N.S. *Savannah* alongside STURGIS at James River

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Mamie's Two Surface Nukes; USS Eisenhower & *Savannah*

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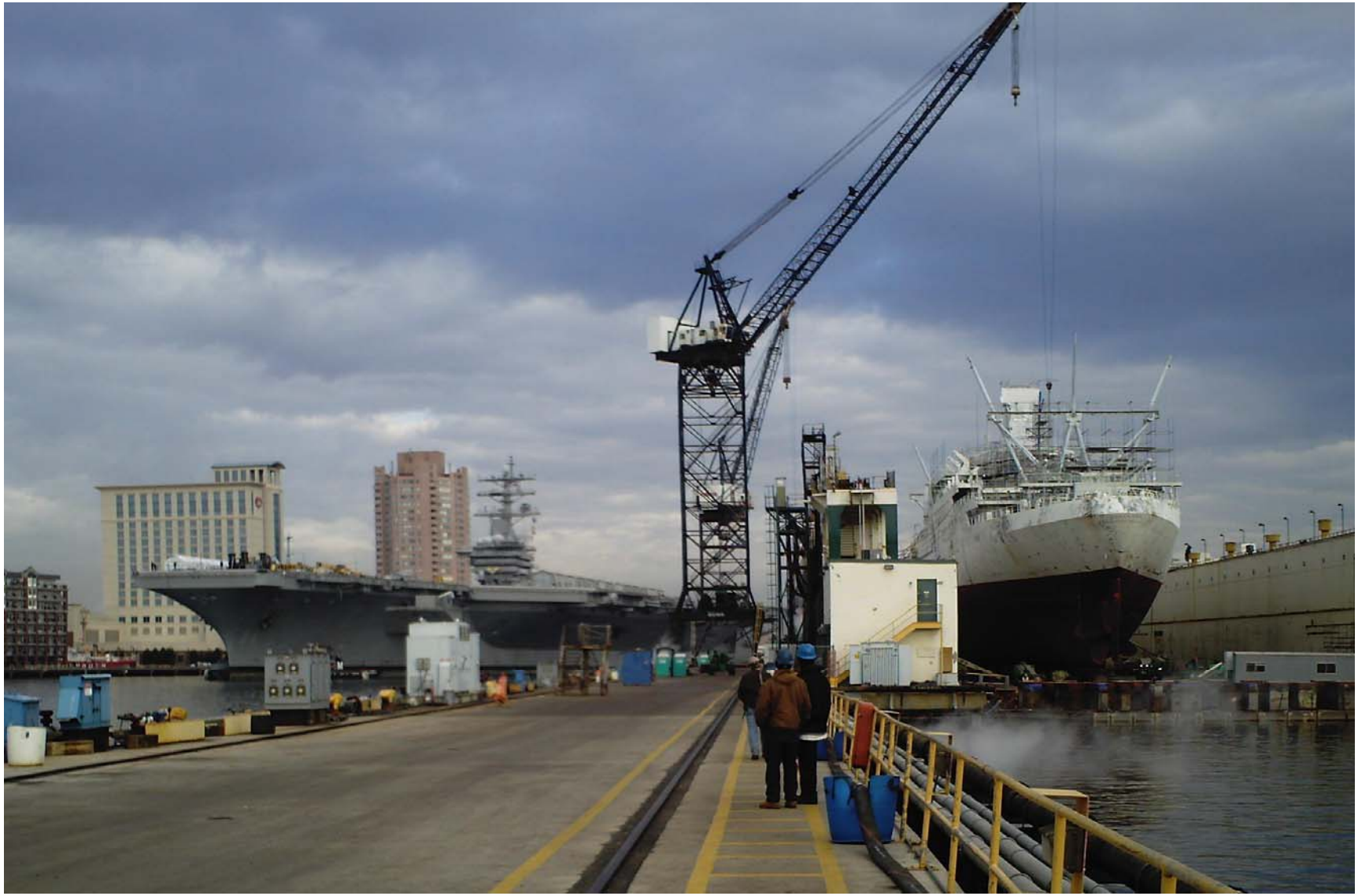

N.S. *Savannah*; arriving Baltimore May 8, 2008

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N.S. *Savannah*; arriving Baltimore, May 8, 2008

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N.S. *Savannah*; National Maritime Day, May 22, 2008

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