A single neutron, a sub-atomic particle of matter, propelled at high speed against the center, or nucleus, of an atom of uranium will split the nucleus and release its energy in the form of heat. Borduring a mass of uranium with neutrons in a nuclear furnace called a reactor causes a continuous splitting of the fuel nuclei in a chain reaction, with a consequent continuous production of heat energy. This is what energy provides the power motive for the Nuclear Ship: SAVANNAH.

The nuclear reactor aboard the SAVANNAH is charged with 682,000 thistle-sized pellets of enriched uranium oxide, the fuel which replaces wood, coal or oil of earlier steamships. The total weight of these pellets of fuel is only 17,000 pounds, yet they will provide energy enough for 16,000 hours of steam at full power, or three and a half years of normal operations. At a cruising speed of 21 knots, SAVANNAH can travel 336,000 nautical miles on a single fuel load. More than 90,000 tons of fuel oil would be required for similar performance by a conventionally powered ship.

The SAVANNAH’s nuclear reactor is located in a huge steel container within the ship and immediately forward of the bridge. Within the reactor, boron coolant rods serve as “stoppers” for the nuclear reaction. Fully immersed into the fuel core, the rods absorb the neutrons and shut down the reactor by intercepting the chain reaction. As the rods are withdrawn from the core, the chain reaction starts again and the amount of energy produced is governed by the distance the rods are withdrawn. Under operating conditions, the rods are adjusted by the reactor operator in the control room until the proper degree of heat is achieved.

Water, under the enormous pressure of 1,735 psi, per square inch so that it will not boil, absorbs the reactor heat and transmits it at an acceptable rate of temperature to the boiler system. In a heat exchange, steam is produced in a secondary water system. It is this steam which drives the turbines and ultimately the propeller shaft of the ship. The spent steam is recompressed to water as it passes through a chamber surrounded by a heat exchanger cooled by the ocean water if it is in the warm ocean, or heated by the power of the heat exchanger.

The SAVANNAH’s nuclear power plant operates with a rigidly controlled chain reaction, thus releasing energy in the form of heat for conversion into steam, the conventional power for the propulsion. If the reactor is not adjusted to a proper balance, it will be extinguished. This is highly unlikely, the principal nuclear damage would be a melting of its steel container.

At components of the nuclear reactor, as well as the heat exchanger, pressure vessels, pumps and piping, are needed, under strict conditions of sanitation within the heavy steel containment vessel which itself is shielded by 3,000 tons of lead, polyethylene, concrete and timber. The bottom half of the hemispherical vessel is encased in four feet of reinforced concrete, while the upper half is shielded by a 24-inch laminated steel and redwood collision end. This shielding serves the multiple purpose of controlling the products of the fission process and preventing accidental damage to the reactor itself in the unlikely event of a collision at sea.

The operation, as well as the design and construction of nuclear reactors, whether for prime research or other purposes, is governed in the United States by the rigid control of Atomic Energy Commission and U.S. Coast Guard regulations. Public safety is the prime consideration.
Former President Eisenhower proposed in 1955 that the United States build the world's first atomic-powered merchant vessel to demonstrate to the world America's peaceful use of the atom. In December 1958 Congress authorized construction of the Nuclear Ship SAVANNAH as a joint project of the Maritime Administration of the U.S. Department of Commerce, and the Atomic Energy Commission.

On National Maritime Day in 1958, the SAVANNAH's keel was laid at Camden, New Jersey. Construction of the vessel and her powerful nuclear reactor advanced rapidly, and the ship was launched with appropriate ceremonies on July 21, 1960. Extensive outfitting, finishing and testing now proceeded, and by the end of 1961 SAVANNAH's reactor had been heated and put into operation for the first time. The ship went to Yokosuka, Japan, for her first trading voyage, after which she put into port at Kobe in Japan. The trip was made at an average speed of 18 knots, the ship's design cruising speed.

After the sea trials came SAVANNAH's eagerly-awaited maiden voyage. Sailing from her home port of Savannah, Georgia, in August 1962, the ship sailed to Norway, Sweden, and then steamed through the Panama Canal to visit ports along the West Coast and in Hawaii. This journey also marked the inauguration of commercial use of her spacious passenger services and modern cargo facilities. Afterward, in early 1963, the SAVANNAH sailed to Galveston, Texas, for maintenance at her general nuclear servicing port.

Instead of resuming her scheduled port visits in May 1963, the ship was immobilized by labor troubles. As a result, a new general agent (American Export Lines) was named and a new crew trained to operate the ship.

Completely re-equipped for her maiden transatlantic crossing (summer 1964), the N.S. SAVANNAH began her second series of domestic visits — this time to Gulf Coast and Eastern seaports — in May 1964.

In future years, after the SAVANNAH has welcomed those who wish to visit her and completed her demonstration voyages, the ship may enter into regular scheduled commercial service.

The Nuclear Ship SAVANNAH represents only the first short step down a long road that may hold promise for the use of nuclear power in commercial ships of the future. By transforming the concept of nuclear power for merchant ships into a reality, SAVANNAH has secured a place in maritime history. The ultimate effect upon that history, however, awaits the decision of time.

Out of the technical experience derived from the design, construction and operation of SAVANNAH and the associated reactor development program have come designs for compact new reactor systems — the first nuclear-powered designs thought to be suitable for use in the maritime industry. SAVANNAH's operations to date have evolved a framework of regulations, guidelines, standards and agreements that may lead to possible commercial use of nuclear power in merchant ships in busy foreign and domestic ports. From SAVANNAH's training programs may flow personnel to meet the exacting demands of any future nuclear ship opera-

Experience with SAVANNAH's nuclear power reactor promises development of smaller, more powerful marine reactors (left, right).
N.S. SAVANNAH

From gracefully fired bow to modified cruiser stern, the streamlined N.S. SAVANNAH measures 595 feet overall. Her beam is 78 feet, her draft 29.5 feet. Capable of moving at 25 knots, the 22,000 ton ship carries 60 passengers and 9,400 tons of cargo.

This drawing to the right and the color-keyed legend below provide a brief explanation of SAVANNAH's ultra-modern propulsion system:

- Red: Radioactive water in the Primary System circulates through the reactor. Fusion-produced heat is captured by this water and carried to the Heat Exchanger.
- Blue: The Secondary System, non-radioactive water circulates the Heat Exchanger and is converted to steam. This steam drives a turbine which turns SAVANNAH's propeller shaft.
- Green: Sea Water is used to cool and condense spent steam, which is then returned to the Heat Exchanger for reuse.

This explains how the SAVANNAH's unique propulsion system works.
These Deck Plans show the attractive and ample spaces allocated to SAVANNAH's passengers. The public rooms, modern and colorful in design, are conveniently located on the Promenade Deck. "A" Deck provides air-conditioned accommodations for 60 passengers, with a private bath for each stateroom. The Dining Room is located on "B" Deck.