



TECHNICAL
PRESS INFORMATION
N.S. SAVANNAH

COMPILED FOR THE
U.S. ATOMIC ENERGY COMMISSION
U.S. DEPARTMENT OF COMMERCE
MARITIME ADMINISTRATION

BY NEW YORK SHIPBUILDING CORPORATION, CAMDEN, NEW JERSEY

PART V

PERSONNEL TRAINING

The personnel who will be responsible for the SAVANNAH when she goes to sea will be experienced seamen, highly trained as specialists regarding the nuclear power plant they will literally put on display in the ports of the world.

The responsibility for operation of the SAVANNAH has been contracted by the Government to States Marine Lines (SML). The responsibility for the nuclear training of the engineers and deck officers who will be in command has been assigned to the Atomic Energy Division of the Babcock and Wilcox Company (B&S), prime contractor for the nuclear propulsion plant.

The program under which the men are being trained is a cooperative effort of the Maritime Administration and the Atomic Energy Commission, and the prime contractors.

The selected site for the training program is the quiet campus of Lynchburg College, located in the heart of Lynchburg, Virginia. B&S's Atomic Energy Division, including its manufacturing plant and critical test facility, is located just a few miles out of Lynchburg.

TRAINING PROGRAM

The following course of study is being followed by the first class of men to undertake training for operating the nuclear propulsion system of the SAVANNAH. The entire course requires 15 months to complete, and the first class has already completed practically all of

(More)

the classroom work, plus some actual reactor operating time in B&W's critical facility.

The relationship of the training program to the second and third classes is covered later, under Selection of Operating Crews.

DESCRIPTION OF COURSES

ORIENTATION - This includes the usual introductory talks, guided tour of the facilities, review of the training program that lay ahead and its objectives, plus a glossary of terms peculiar to nuclear reactors, and wherever possible, synonymous words related to the experience of the men in class.

INTRODUCTION TO NUCLEAR POWER - Nuclear power - its history, status, and future, especially in marine propulsion, starts this course. It is then followed by the basic concepts and terminology of nuclear power, atomic particles, radioactive particle emission, changing mass to energy, nuclear reactions, neutron behavior, nuclear fission, the chain reaction and its control, nuclear reactors, reactor materials, reactor systems and auxiliaries, reactor loop components, reactor heat transfer, and nuclear reactor design. This is primarily a lecture course, taught with a number of visual aids. Its purposes are to: (1) orient the trainee in the nuclear field, (2) provide the trainee with an overall view of the scope of the training program, and (3) familiarize the trainee with the language of the nuclear field.

MATHEMATICS - A review of calculus, following by an introduction to differential equations.

PHYSICS - First review the basic physics, followed by the fundamentals of atomic structure and behavior, including charged particles, x-rays,

(More)

relativity, the Bohr theory, elementary quantum theory, and wave particle dualism. This will be followed by the basic concepts of nuclear physics, including a study of the spontaneous disintegration process, alpha particles, beta particles, gamma rays, the behavior of neutrons, and special emphasis on the fission process. Study procedure consists of one hour of lecture per day followed by a one-hour problem and tutoring session.

THERMODYNAMICS - A review of steam properties, the steam tables, Mollier diagram and vapor cycles, with major emphasis on setting up a heat balance for components and systems.

ELECTRICITY - A review of direct current, alternating current, and magnetism. Also, study of the electrical generation and distribution system as installed in the SAVANNAH.

INSTRUMENTATION - Basic electronics, instrumentation and control, description of the systems and their functions, and special operating and maintenance considerations. The SAVANNAH's entire nuclear instrumentation and control is covered.

REACTOR THEORY - Elements of reactor theory, description of reactors and reactor systems, reactor materials, radiation protection, thermal shielding considerations and heat transfer, neutron physics, radioactivity, fission process and chain reaction, reactor analysis, time behavior of reactors, fuel cycles and fuel reprocessing, fluid flow, and selection of nuclear fuels.

LYNCHBURG POOL REACTOR - The trainees, through use of the B&S Lynchburg pool reactor, will become familiar with operation of a reactor for the first time. By performing several experiments with the reactor, the

trainee better understands the course work in controls, reactor theory, and physics. It prepares the trainee for the low power reactor laboratory.

CHEMISTRY LABORATORY - Here, the trainees will perform a series of experiments that include a cross section determination, use of the scintillation method of radiation detection, operation of Geiger-Muller counter and statistics of counting, operation of survey type radiation detectors, and basic training in film badges and pocket dosimeters.

LOW POWER REACTOR LABORATORY - This is the first opportunity the trainee has to operate a reactor following the pool reactor training. Here the trainee performs critical experiments, rod calibrations, flux mapping, and determines danger coefficients. The trainee can also experimentally verify previous study work done in the classrooms.

CHEMISTRY - This is a study of the basic concepts of chemistry and their application to the chemical problems that may be encountered in operating and maintaining the SAVANNAH's reactor. Special emphasis is placed on the mathematics of such applications.

MATERIALS - The peculiar property requirements of primary system structural materials, fuel materials, and control materials will be studied, plus the practical considerations of corrosion and the effects of radiation.

HEALTH PHYSICS - Here the trainee learns the radiation hazards, how to measure radiation, and how to work with radioactive materials and equipment. Accident prevention and emergency procedures are also taught.

REACTOR CORE DESIGN - This includes the mechanical design of the reactor core, critical factors in core design, maximum fuel temperatures, "hot spots," flux distribution, coolant flow, and how these factors are influenced by operating procedures.

MECHANISMS - A complete study of control rods, their mechanisms, how they operate and function in the reactor, their removal, and their maintenance.

HEAT TRANSPORT SYSTEM - Fluid conditions and description of primary loop, primary pumps, gate valves, check valves, steam generating units and their characteristics of operation, and maintenance of the loop as a system.

AUXILIARY SYSTEMS - For each system, a study of the function, need, physical description of the system and its components, safety considerations, related instrumentation and control, operation of the system, and preventive and emergency maintenance. This includes all systems except heat transport, reactor, propulsion machinery and secondary loop, which are covered separately.

PROPULSION SYSTEM - A study of system operation of the secondary loop including boilers, steam system, turbo-mechanical drive, reduction gears, condensers, and feedwater system, which includes the evaporators.

OPERATION AND MAINTENANCE - Operation and maintenance studies will be extensive and thorough, with classroom work coordinated and demonstrated on the SAVANNAH simulator. Emergencies will be discussed at length so that students will be prepared to handle any eventuality. They will be taught to act with confidence, and will be thoroughly grounded in both normal and emergency operating procedures.

STUDY HOURS - The above represents a total of almost 1,500 hours of classroom work. In addition, the lodge which States Marine Lines provided for their officers to occupy in Lynchburg has a special study room equipped with a blackboard. It is almost a daily occurrence for some of the instructors to go to the lodge in the evening to answer students' questions and go over special problems. When this session ended, the students still had hours of "home work" to do for the next day's class. The classroom portion of the course started in September, 1958, and ended in May 1959, for the first class. The trainees are now in the field-training phase of the course.

INSTRUCTORS - The classes are taught by highly qualified men from the Atomic Energy Division of B&W. These men, in addition to the regularly scheduled classes, gave up much of their free time to assure a thoroughly trained crew for the SAVANNAH.

SHIPYARD TRAINING - About one-half of the students at a time will be sent to the New York Shipbuilding Corporation's, Camden, New Jersey, Shipyard to observe and assist in the start-up and testing of the SAVANNAH power plant. They will also use the mock-up of the ship's nuclear power system for additional training. (See Appendix "B")

FIELD TRAINING - All students will also participate in field trips, spending five weeks at the Atomic Energy Commission's Hanford Works Washington; five weeks at the General Electric Vallecitos Boiling Water Reactor near Pleasanton, California; one week studying control rod drives at G.E.'s Nuclear Products Division, San Jose, California, and four weeks at the Army Package Power Reactor, Fort Belvoir, Va.

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This will enable the students to experience on a first hand basis many of the classroom topics, and familiarize themselves with systems other than the pressurized water system.

VISUAL AIDS - Wherever possible, visual aids are used. This includes a full scale mock-up of the nuclear power plant at the shipyard (see Appendix "B") plus other models of the SAVANNAH and its power plant. Of particular importance is the control-panel simulator, as described below.

SAVANNAH SIMULATOR:

The simulator is a full scale, operating model of the main control panel as it will be on board the SAVANNAH. Electrically connected to the simulator is a problem board and an electronic computer. The instructor uses the problem board to establish any combination of operating conditions he desires. These conditions then show up on the main control board, and the student solves the problem by taking appropriate action. The computer takes the place of the actual reactor, duplicating all operating conditions that may confront the operator at any time.

The simulator employs a graphic representation of the entire propulsion system. It is color coded, with certain colors applicable to specific parts of the system for quick and accurate recognition.

Each student will receive six weeks training on the simulator. The class is divided so that some students are on field trips while others are getting the simulator training.

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When the student finishes his course on the simulator, he will be thoroughly familiar with the exact control panel as it will be on the ship, and will be able to apply all of his learning to meet any situation that may arise when the SAVANNAH goes to sea.

SELECTION OF OPERATING CREWS:

There are actually three classes now undergoing training in the SAVANNAH personnel program. The first class of 33 men will take the entire 15-month course as outlined above.

This class is a composite group - 13 men are engineering officer candidates for the SAVANNAH and as such are employed by States Marine Lines. The remaining 23 trainees are representatives of various steamship companies, ship building and repair organizations, maritime educational institutes, and U.S. Coast Guard marine inspection officers. Such engineers will provide a nuclear background for their respective organizations upon completion of the course.

The second class consists of 11 additional engineering officer candidates, all of whom have a science degree from an accredited school, and will therefore take an accelerated course that will not include subjects such as mathematics, physics, etc. These men are also employed by States Marine. The second class also includes seven men from Denmark, England, Holland, and Japan who are sponsored by the USAEC.

From the 24 States Marine Line officers referred to above, the initial and relief complements will be selected.

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The third class, which is for senior deck officers, consists of five men, all of whom hold a ship masters license and are employed by SML. Their course of study will be somewhat shorter than that of the second group, but will provide them with a thorough working knowledge of the nuclear propulsion system of the ship they will command.

SELECTION PROCEDURE:

The men who will operate and command the SAVANNAH represent one of the most select and thoroughly trained crews ever assembled for one ship.

States Marine Line was selected to man and operate the SAVANNAH by the Maritime Administration and the Atomic Energy Commission. The shipping firm accepted and screened applications from men of their own fleet as well as from other marine interests. These men were then given aptitude tests and personal interviews.

The tests were divided into two phases, each requiring four hours to complete, and were administered by the Educational Testing Service of Princeton University. Phase one consisted of an achievement test equivalent to a college entrance examination, emphasizing pre-engineering comprehension. Phase two consisted of three parts, verbal, mathematics, and mechanics. It was essentially the same test used for admittance to the Merchant Marine Cadet Corps for the Maritime Academy.

Upon successful completion of the tests, each man was interviewed by B&W Atomic Energy Division representatives to determine his ability to absorb the planned study program. Since all of the men passed the tests and interviews, final selection was based entirely on those

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having the highest scores. This is significant in view of the fact that these men represent considerable experience at sea, but had little in the way of formal college education.

BIOGRAPHIES:

The operating and command personnel of the SAVANNAH will be drawn from the following current employees of the States Marine Lines who are now undergoing training for the assignment:

FIRST TRAINING CLASS

Albino, John A.; 24 yrs. old; single

Born: Brooklyn, New York

Home Address: Brooklyn, New York

Education: BMS, New York State Maritime College

Sea Experience: Less than year

Bersen, John; 31 yrs. old; Married

Born: East Orange, New Jersey

Home Address: Mountain Lake, Shawnee, New Jersey

Education: Union High School, N.J.

Maritime Service School, Sheepshead Bay

A. B. S. School, Philadelphia, Pa.

Sea Experience: Six years

Boyett, Roy; 33 yrs. old; Married

Born: Haynesville, Louisiana

Home Address: Billings, Montana

Education: Vivian High School

Rodessa High School, Louisiana

Sea Experience: 15 years

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Bradford, Francis C.; 39 years old; Married

Born: Eagle River, Wisconsin

Home Address: Anaheim, California

Education: Eagle River High School, Wisconsin

Lawrence College, Wisconsin

La Crosse State Teachers College, Wisconsin

Sea Experience: 12 years

Green, John Jay; 31 yrs. old; Single

Born: Bellevue, Washington

Home Address: Bellevue, Washington

Education: U. S. Merchant Marine Academy

Sea Experience: Seven years

Kennedy, Robert Jr.; 31 yrs. old; Married

Born: New York, N. Y.

Home Address: Staten Island, New York

Education: U. S. Merchant Marine Academy

Sea Experience: Seven years

King, Lawrence; 25 yrs. old; Single

Born: Jersey City, New Jersey

Home Address: North Bergen, New Jersey

Education: St. Peter's Prep

U. S. Merchant Marine Academy

Sea Experience: Two years

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Morrissey, James A.,; 49 yrs. old; Married, 1 son

Born: Worcester, Massachusetts

Home Address: Wantagh, New York

Education: High School of Commerce, Worcester, Massachusetts

Sea Experience: 24 years (Presently sails as Chief Engineer)

Ryerson, Charles R.; 41 yrs. old; Married, 1 daughter

Born: Rutherford, New Jersey

Home Address; Laurelton, Long Island, New York

Education: Rutherford High School, New Jersey

Sea Experience: 18 yrs. (Presently sails as Chief Engineer)

Schonbachler, Frank L.; 38 yrs. old; Married

Born: Buckley, Washington

Home Address: Enumclaw, Washington

Education: Enumclaw High School, Washington

U. S. Maritime School, Alameda, California

Sea Experience: 12 years

St. Laurent, Herbert A.; 39 yrs. old; Married, 1 daughter

Born: Worcester, Massachusetts

Home Address: Seattle, Washington

Education: U. S. Maritime School, Alameda, California

Sea Experience: 16 years

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Townsend, Andrew G.; 36 yrs. old; Married

Born: Alameda, California

Home Address: Lafayette, California

Education: Alameda High School

Sea Experience: 16 years

Weidman, John J.; 30 yrs. old; Single

Born: Philadelphia, Pennsylvania

Home Address: Maple Shade, New Jersey

Education: Temple University H. S.

Sea Experience: 12 years

SECOND TRAINING CLASS:

Beuacqua, Frank L.; 32 years old

Born: Pennsylvania

Home Address: Jersey City, New Jersey

Education: Columbia University (B.S.)

Sea Experience: 10 years

Brynda, William J.; 33 yrs. old; Married

Born: New York, N.Y.

Home Address: Great Neck, N.Y.

Education: U. S. Merchant Marine Academy (B.S.)

Sea Experience: 3 years

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Canevari, Frederick J.; 34 yrs. old; Single

Born: Norwalk, Connecticut

Home Address: East Norwalk, Connecticut

Education: U. S. Merchant Marine Academy (B.S.)

Sea Experience: Five mos.

Duclos, Robert M.; 31 yrs. old; Single

Born: Albany, N.Y.

Home Address: Woodhaven, N.Y.

Education: New York State Maritime Academy (B.M.S.)

Sea Experience: Five years

Edwards, Thomas E.; 23 years old; Single

Born: Spokane, Washington

Home Address: Ritzville, Washington

Education: U. S. Merchant Marine Academy (B.S.)

Sea Experience: Two Yrs.

Davis, Freeman V.; 26 yrs. old; Single

Born: Waltham, Mass.

Home Address: Dorchester, Mass.

Education: Massachusetts Maritime Academy (B.S.)

Sea Experience: Two years

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Flynn, Floyd E.; 22 years old; Single
Born: Toledo, Iowa
Home Address: Toledo, Iowa
Education: U. S. Merchant Marine Academy (B.S.)
Sea Experience: Eight months

Lezenby, Alfred J.; 37 years old; Single
Born: Vineland, New Jersey
Home Address: Fort Lee, New Jersey
Education: U. S. Merchant Marine Academy
University of Delaware (B.M.E.)
Sea Experience: Seven years

O'Leary, James P.; 34 years old; Single
Born: Lancaster, Ohio
Home Address: Groton, Connecticut
Education: U. S. Merchant Marine Academy (B.S.)
Sea Experience: One year

Wheatly, Stanley D.; 33 years old; Married
Born: Detroit, Michigan
Home Address: Bayside, Long Island, N.Y.
Education: Adm. Farragut Academy
U. S. Merchant Marine Academy (B.S.)
Sea Experience: 10 years

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Zahardis, Anthony; 34 years old; Single

Born: Steubenville, Ohio

Home Address: Bay Shore, N.Y.

Education: University of Arizona (B.S.M.E.)

Sea Experience: Four years

SENIOR DECK OFFICERS (Third Training Class):

Egle, August J. C.; 34 years old; Single

Born: Brooklyn Park, Maryland

Home Address: Glen Burnie, Maryland

Education: Baltimore Polytechnic Institute, Baltimore, Md.

Fort Trumbull O. C. S., New London, Conn.

Sea Experience: 15 years

De Groote, G. R.; 54 years old; Married

Born: Belgium

Home Address: Huntington, Long Island, N.Y.

Education: Schoolship, Ostend, Belgium

Sea Experience: 39 years

Mc Michael, David B.; 46 years old; Single

Born: Montana

Home Address: Tampa, Florida

Education: California Maritime Academy

Sea Experience: 20 years

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Meyer, William W.; 40 years old; Married, 2 children

Born: San Francisco, California

Home Address: Oakland, California

Sea Experience: 25 years

Blanckenberg, Theodore; 38 years old; Single

Born: Berkeley, California

Home Address: Berkeley, California

Education: University of San Francisco

California Maritime Academy

Sea Experience: 8 years