government benediction. Safety practices for the *Savannah* reactor are in large part modeled after those for land-based reactors, depending basically on containment, and the *Savannah* is subject to all the procedures developed by the AEC for the licensing of stationary power reactors to commercial companies. This means that, except for small housekeeping details, the Joint Group's recommendations must be reviewed by the AEC's Advisory Committee on Reactor Safeguards, by the AEC's regulatory staff, by a reactor licensing board, and finally by the AEC commissioners themselves.

For the most part the government agencies responsible for the *Savannah* appear to work together harmoniously. If they divide at all, it is over the relative emphasis given the goals of safety and commercial attractiveness. The Joint Group is in no way incautious, but it does resist the tendency of the AEC advisory and regulatory staffs to pile on additional safeguards which it feels jeopardize the *Savannah's* economic appeal without substantially adding to its safety.

Tugboat Troubles

This divergence is well illustrated by a currently unresolved disagreement about the presence of tugboats while the *Savannah* is in port. Tugs are used for the *Savannah*, as for any ship, in docking and undocking. In addition, however, the AEC has determined that tugs should stay with the *Savannah*, to remove the ship from a central area in event of an accident, until the reactor has cooled to a specified degree and the inventory of fission products in the reactor is very low. In some ports, where the harbor entrance is long and power is reduced several hours before docking, this requirement is not too burdensome. Some ports, however, can be navigated swiftly, and for these, according to the Joint Group, the necessity of keeping tugs around introduces serious problems, not only of cost but of status. The shame of being attended by a tug, to hear the Joint Group tell it, is second only to the shame of the scarlet letter.

Tugs cost about $150 to $200 an hour; if the present ruling of the AEC is adhered to, tugs might have to stand by for as long as 2 days, and tug costs in a single port might run as high as $10,000. While the cost question might not be insurmountable for the government-run *Savannah*, the Joint Group feels it is likely to have an unfavorable effect on the *Savannah*'s attempt to demonstrate the commercial potential of nuclear ships. The tug requirement, the Joint Group recently told the AEC, overlooks the complex and costly variety of safeguards engineered into the *Savannah* to prevent the effects of a possible accident from threatening the crew or public; it will therefore discourage further research on engineered safeguards; will inhibit work currently going on abroad on more powerful maritime reactors, since tugs would be needed even longer for ships equipped with such reactors; and will dampen the interest of domestic operators. It will, according to the Joint Group, encourage labor to demand hazard pay; will lessen the enthusiasm of foreign hosts; and will, in general, have the effect of making the *Savannah* experiment a failure.

Much of the discussion of the ruling now centers on whether, and how fast, tugs would respond to a distress call from the *Savannah*, with the AEC digging up instances where tugs either failed to respond to calls or responded slowly, and the Joint Group (and the tug owners) refuting the AEC's cases and defending the record of the tugs as heroic defenders of the troubled seaman. For the present, the ruling stands, but the Joint Group is busy investigating the tug question and will have an opportunity to make its case sometime in the next few months. Such disagreements, the Joint Group feels, mean not that the *Savannah* is a fiasco but, quite the opposite, that it is doing precisely what it ought to be doing—preparing the way for future generations of nuclear ships.

New Reactors

Even if their results will not always be costly, however, as in the case of the tugs, the procedures for government regulation of nuclear ships are bound to be cumbersome, at least for the foreseeable future. Added to the generally unfavorable economic picture for nuclear ships, the safety restrictions account for the rather wavering attitude of the maritime industry. One of the first positive signs of industry interest was recently expressed by the American Mail Lines, which operates ships between the Pacific Coast and ports in India, Pakistan, the Persian Gulf, and the Gulf of Aden. Partly as a result of the steamship company's interest, the Maritime Administration has initiated a feasibility study covering the possibility of effecting savings to the operator through reductions in fuel weight and increases in speed; the acceptability of nuclear cargo ships in foreign ports; design; and every other aspect of ship operation. Although industry generally has been interested in the development of two new maritime reactors (General Electric's air-cooled reactor 630-A and Babcock and Wilcox's Consolidated Nuclear Steam Generator, or CNSG), for the most part the higher costs of building nuclear ships have apparently outweighed prospects of lower operating costs in most industry calculations for the immediate future. Maritime Administration officials believe, however, that as costs come down, industry interest will rise.

The Atomic Energy Commission submitted a last-minute $13.5-million budget request to the Joint Committee on Atomic Energy for research on the 630-A air-cooled reactor, but was turned down because the committee had had insufficient time to study the request. It is likely that the research will be authorized next year. But industry interest in the new reactors raises the question of the extent to which the *Savannah*, after its long travail, will in fact be a trouble-shooting model for other nuclear ships. Although officials of the Joint Group believe that there will be a generation of nuclear ships modeled on the *Savannah*, none are now in gestation, and with the attention being given to the new reactors, it is hard to see whence they may come. Although politically and psychologically the *Savannah* has probably won some battles, new design and training and safety criteria would have to be devised for future ships, and the *Savannah* may turn out to be as irrelevant to their problems as the *Mayflower*. Thus, after expenditure of $100 million, 9 years of effort, and incalculable hard work on the part of thousands of dedicated men, it is still not altogether clear whether the N. S. *Savannah* is a boon or a boondoggle.

—ELINOR LANGER

(*This is the second of two articles on the N.S.* Savannah.)

Announcements

The National Science Foundation has announced the formation of a special commission on **weather modification.** Establishment of the 11-member commission resulted from a request by the Federal Council on Science and Tech-

nology for NSF to prepare an analysis on the status and potential of weather modification, including the scientific, social, and economic aspects of the problem. The group is independent, but responsible to the National Science Board. Its members are John Bardeen, University of Illinois; Adrian R. Chamberlain, Colorado State University; William G. Colman, Advisory Commission, Intergovernmental Relations; John C. Dreier, School of Advanced International Studies, Johns Hopkins; Leonid Hurwicz, University of Minnesota; Thomas F. Malone, Travelers Insurance Company; Arthur W. Murphy, Columbia Law School; Sumner T. Pike, Trident Packing Company; William S. von Arx, Woods Hole Oceanographic Institution; Gilbert F. White, University of Chicago; and Karl M. Wilbur, Duke University.

Grants, Fellowships, and Awards

The University of Colorado medical school invites M.D.'s to enter papers on **thrombophlebitis and basic vascular problems** in the third Cochems competition. The prize for the paper judged best is $2500. Papers must be submitted in triplicate, and may not be published until after the winner has been announced early next year. Deadline: *15 November*. (J. J. Conger, School of Medicine, University of Colorado Medical Center, 4200 East Ninth Ave., Denver, Colorado 80220)

Wayne State University plans a three-part institute on **experimental stress analysis** and mechanical behavior of materials. The fees listed include necessary texts, notebooks, and equipment; special tuition rates are available to persons enrolling for more than one course. Additional information is available from J. Der Hovanesian, Department of Engineering Mechanics, Wayne State University, 655 Merrick, Detroit, Michigan 48202. The courses are:

Strain gages, 21–25 September, fee $200. Lectures and laboratory work with emphasis on brittle coating, basic mechanics laws, strain-sensitive materials, wire and foil gages and strain game circuits, fastening, amplifiers, indicators, recorders, telemetering, taping, rosette and dynamic analysis, transducers, and commercial equipment.

Mechanical behavior of materials in design, 9–12 September, fee $150. Will emphasize modern theories on fatigue; failure; creep, temperature related properties; stress concentrations; shock, impact, fracture analysis and interpretation; damping properties; and reliability.

Photoelasticity, 14–18 September, fee $200. Will include lecture and laboratory sessions on the newer developments, with stress on the study of coatings.

Courses

The Instrument Society of America is accepting applications for an intermediate level course on **gas chromatography**, scheduled 30 November to 4 December in Pittsburgh, Pa. The course will provide advanced training in industrial applications of gas chromatography for engineers and other technical personnel responsible for process and laboratory instrumentation. (ISA Gas Chromatography Short Course, ISA, 530 William Penn Place, Pittsburgh, Pa. 15219)

Ohio University, Athens, and Battelle Memorial Institute will sponsor the second **research management** program, 4 to 16 October. The course is designed primarily for scientists and engineers who have recently assumed managerial responsibilities. (M. N. Brinkman, Ohio University, Athens)

The School of Extension Studies of the Industrial College of the Armed Forces offers a correspondence course on "the **economics of national security.**" The 1-year course includes training in principles of management, employment of human and natural resources, research and development, national intelligence, military supply management, defense requirements and procurement, economic foreign policy, global psychological conflict, and new dimensions in the cold war. No tuition is charged, and texts are furnished by the government. Participants, if civilians, must have a bachelor's degree or 12 years' business experience; military officers must hold at least the rank of major. (Commandant, Industrial College of the Armed Forces, Washington, D.C., Attn: Correspondence Course Division)

An advanced course in **interpretation** of **complex arrhythmias** will be offered at Michael Reese Hospital and Medical Center, Chicago, Illinois, 30 November to 5 December. It is intended for experienced electrocardiographers and registration is limited to 30 persons. (B. Petzold, Cardiovascular Institute, Michael Reese Hospital and Medical Center, Chicago 16)

Erratum: In the paper "Gamma-globulin affinity for normal human tissue of the central nervous system" by C. D. Allerand and M. D. Yahr, which appeared on pp. 1141–42 of *Science* for 29 May, the beginning of the last paragraph should read: "The concomitant fluorescence of myelin sheaths with glial cells is of note in view of the concept that the sheath is derived from glial cell membrane (*11*). The specificity of 7*S*γ-globulin. . . ."

Erratum: Figure 1 of the meeting report, "Early man in the New World" by George A. Agogino *et al.* [*Science* **143**, 1351 (20 Mar. 1964)] contained editorial errors and lacked details on the cross sections of the paleo point types. The corrected figure is reproduced below: "Paleo point types. (*A*) Angostura; (*B*) and (*C*) Agate Basin; and (*D*) Frederick. [Drawings by Shirley East]"