Nuclear Ships

The age-old dependence of man upon wind and muscle to propel his ships began to come to an end nearly a century and a half ago when the Savannah, equipped with sails and an auxiliary 90-horsepower, one-cylinder steam engine and fueled by 75 tons of coal and 25 cords of wood, became the first American ship to use steam for an Atlantic crossing.

This notable accomplishment is celebrated yearly on National Maritime Day, 22 May. But the celebration this year was more than a commemoration. It was marked by an event that foreshadows another great change in marine transportation: the laying of the keel of the world’s first nuclear-powered passenger-cargo vessel, which will be appropriately named the N. S. Savannah (“N.S.” for nuclear ship), after its pioneering predecessor.

The new Savannah, which is scheduled to be completed in 1960, will not be outstanding among modern vessels either in power or in speed: its shaft horsepower will be only 22,000, its running speed slightly more than 20 knots. Its significance lies rather in its use as an experimental commercial ship for the determination of the costs and the problems of nuclear propulsion.

So far as costs are concerned, no one expects the Savannah to be able to compete with conventional ships: the high initial expense of building—estimated at $40.25 million—will not be offset by its infrequent need for refueling. The Savannah is expected to run for some 300,000 miles or about three and one-half years on a single charge of 60 kilograms of enriched uranium oxide.

But in time costs will doubtless be reduced to the point at which nuclear ships will become competitive and more than competitive. Before that time comes, it is well to consider some of the special risks that are inherent in nuclear ships both for their crews and ports of call.

As P. T. Fletcher of the United Kingdom Atomic Energy Authority has recently pointed out [Atom 19, 10 (May 1958)], one of the major problems of using a nuclear reactor in a ship will be to contain the fission products, especially in case of accident. Fire, collision, failure of the cooling system, or corrosion of the containing jacket could bring about release of the radioactive fission products with consequent danger to the crew and passengers if the ship were at sea or to a much larger number of people if the ship were in port.

The hazards can, as Mr. Fletcher notes, be reduced, but not eliminated, by engineering safeguards—the reactors can, for example, be designed for automatic flooding in emergencies—and by specially trained crews alert to all of the possibilities of mishap. In most emergencies the hazards to large numbers could be reduced by towing the ship out to sea.

If nuclear-powered ships are to become useful commercially, the governments of the ports that receive them will be obliged to undertake the new and demanding tasks of monitoring for radioactivity and warning the public in possible emergencies.

Cities that serve as ports will probably be the first to cope with the new problems of the atomic age, but as land-based nuclear reactors become more abundant and as the transportation of uranium fuel and radioactive wastes increases, inland cities will also need to make a suitable response. Perhaps “radiation departments” will become as standard in municipal governments as police and fire departments are now.—G. DuS.
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Meetings

Science and Mathematics
Teacher Education

The Mideast Regional State College Conference on Science and Mathematics Teacher Education was held in Washington, D.C., on 7 and 8 March 1958, under the sponsorship of the Science Teaching Improvement Program of the American Association for the Advancement of Science. (The conference was made possible through grants from the Carnegie Corporation of New York and the General Electric Educational and Charitable Fund.) The original stimulus for this conference was provided by the successful completion of a similar conference, also sponsored by the Science Teaching Improvement Program, held in the Midwest last year. The purpose of these conferences is to bring together representatives of the mathematics and science faculties of the state colleges in order that they may have the opportunity to exchange views with others concerning current developments in science and in better teaching of science. Since a large percentage of the future teachers in our public schools will be produced in these state colleges, and since experimental programs in education are being conducted in many of them, it is also desirable that representatives from these institutions meet with representatives of the organizations interested in improving the teaching of science in the high schools.

Participants in the Mideast Conference included representatives of the science and mathematics departments of state colleges of the District of Columbia, Maryland, New Jersey, New York, Pennsylvania, Virginia, and West Virginia; high-school supervisors of science and mathematics from the Washington metropolitan area; and other leaders in science and mathematics education. In all, approximately one hundred persons participated in the conference.

The conference was opened with a challenge to face new times and new tasks with an open mind and a determination to develop the best possible educational system for American democracy. Topics developed in subsequent addresses included: science and mathematics in the Soviet ten-year school; a review of current experimental programs in the United States in science and mathematics teaching, particularly at the secondary level; a plea for coordination of the science programs at the elementary, secondary, and collegiate levels; suggestions for improvements in curriculum for the training of teachers of science and mathematics; and recommendations for revision of secondary school curriculum in science and mathe-
Mathematics to meet the rapid advances currently observed in these fields.

No resolutions were adopted by the conference, but recommendations of the discussion groups in both mathematics and science included the following:

1) Programs of preparation for teachers of mathematics and science should be designed to provide strong concentration (one-half of the total number of college hours) in the general academic area to be taught, with sufficient concentration in a specific subject to prepare the teacher for graduate work in that field.

2) All teachers for elementary schools should have training in biological sciences, physical sciences, and mathematics equal to at least a one-year college course in each.

3) It is strongly recommended that further experimental studies of the curriculum content of both high-school and college courses in mathematics and science be made in an effort to improve training in these fields.

4) An organized program providing adequate counseling service in mathematics and science for secondary teachers should be established in all school systems. This program might be modeled after the STIP program.

5) Teaching loads should be reduced to a reasonable level, with adequate allowance provided for time spent on extracurricular activities. In figuring work loads, total clock hours should be used as the criterion, with laboratory hours carrying equal credit with class hours.

6) Colleges should establish special-content courses in science and mathematics for in-service training of teachers. These courses should provide the breadth of knowledge required in teacher training, and should carry graduate credit.

Joshua R. C. Brown
American Association for the
Advancement of Science,
Washington, D.C.

Engineering Education

The American Society for Engineering Education will hold its annual national meeting from 16 to 20 June on the Berkeley campus of the University of California. During that week more than 1000 engineers and educators will gather to present and discuss recent progress toward increasing the effectiveness of engineering and applied science instruction in the nation’s schools and colleges.

Four general sessions of the society will cover such topics as engineering accrediting procedures; research and the engineering college; improved use of facilities and staff; a survey of nuclear manpower; and the development of engineering faculties. Conferences of the Engineering College Administrative
Cancer Council and the Engineering College Research Council will also be held during the 5-day gathering. For further information, address Prof. E. P. DeGarmo, Division of Industrial Engineering, University of California, Berkeley 4, Calif. Registered attendance by nonmembers is cordially invited.

Australasian Conference on Radiation Biology

The second Australasian Conference on Radiation Biology will be held at the Cancer Institute, Melbourne, Australia, 15–18 December. Guest speakers at the conference will be L. H. Gray, director of the British Empire Cancer Campaign, Radiobiological Research Unit, Mount Vernon Hospital, London, and J. F. Loutit, director of the Medical Research Council Radiation Biology Unit, Harwell, Didcot, Berkshire, England.

Papers on relevant subjects are invited. Titles and a 250-word abstract should be submitted by 31 July. Registration forms and other information may be obtained from J. H. Martin, Physics Department, Cancer Institute Board, 483 Lonsdale St., Melbourne, Victoria, Australia.

Forthcoming Events

July

2–5. Ferro and Antiferromagnetism, IUPAP Colloquium (by invitation), Grenoble, France. (L. Neel, Dept. of Experimental Physics, Univ. of Grenoble.)

2–5. Rarefied Gas Dynamics Symp., Nice, France. (F. M. Devienne, Laboratoire Mediterranean de Recherches Thermo-dynamiques, 2 avenue Villebois Marceul, Nice.)

4–6. Astronomical League, Ithaca, N.Y. (Miss W. A. Cherup, 4 Klopfer St., Millvale, Pittsburgh 9, Pa.)

4–6. Speleology, intern. colloquium, Brussels, Belgium. (S. Paumen, 183, avenue Nouvelle, Brussels.)


6–12. Research and Development Engineering Seminar, 2nd annual, University Park, Pa. (Extension Conference Center, Pennsylvania State Univ., University Park.)

7–9. Exchange of Knowledge in a Divided World, Chicago, Ill. (H. W. Winger, Graduate Library School, Univ. of Chicago, Chicago 37.)

7–11. Technical and Industrial Communications Inst., Fort Collins, Colo. (Chairman, Dept. of English and Modern Languages, Colorado State Univ., Fort Collins.)


8–11. Institute of the Aeronautical Sciences, summer, Los Angeles, Calif. (S. P. Johnston, IAS, 2 E. 64 St., New York 21.)


(See issue of 16 May for comprehensive list)
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Letters

The Responsibilities of Biologists

In *Science* of 7 February [127, 293 (1958)], Ileen E. Stewart presents excerpts from an address with the above title given by the retiring president of the American Institute of Biological Sciences, H. Bentley Glass, at the Stanford meetings last August. Lest readers of *Science* infer that biologists all approve his rallying call, a response seems in order. At least some of us consider Glass's position confusing, if not confused.

"Responsibility" is predicated upon ethical or philosophical reference points for which definition is essential. Spinoza would have been amused at Glass's equivocations, "the true welfare of humanity" and "social progress." No doubt Stalin stood for these also.

"Our first responsibility as biologists," says Glass, "is really to be biologists." But also, our "fundamental primary obligation" is "the stern duty to teach—to spread as widely as possible . . . comprehension of the bases of a scientific civilization." The possibility of conflict between detachment and evangelism is ignored.

Concerning the "revolutionary and potentially devastating" powers arising from research, he says, "it is a frightening responsibility . . . to see that these powers are used for good and not for harm." He deplores the fact that "so few biologists endeavor to make their biology count outside the laboratory and the classroom." He fears that what "we have gained through centuries of struggle . . . we may lose in a few months if we fail to defend stoutheartedly the freedom of the mind." He decrives authority as "the inveterate foe of scientific inquiry." He worries about control of the purse strings of research and is pleased that "the people and the representatives of the people feel that science is a useful servant or slave to minister to the needs of society as bidden." The distillation of such ideas may well be interpreted as a credo that scientists should run things since they should know what is "best." But, alas, Glass "would feel no confidence in asking the profession of biology to take over regulation of our government and our society," because of inexperience in politics. Considering the plethora of biological societies and how efficiently they operate, inexperience is an odd charge here; but at any rate, it appears that while condemning authority he really would not object to some sort of benevolent aristocracy or technocracy.

The plain fact is that scientists are only human, with the usual foibles and inconsistencies. We formulate the law of gravity but long to repeal it; the utility of death is abhorrent to us individually;
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and the regimentation elucidated in physiology is forgotten when we demand freedom. Biologists are shocked by polygamy, prefer fried chicken to raw, and calculate means for bimodal distributions. We teach evolution, if we can, but sing peace on earth and want our kids to be "normal." We know that symbiosis can lead to parasitism, yet we seek "grants" and favors.

How can Glass expect people so afflicted with professional schizophrenia to make our biology "count" outside the laboratory and classroom? Too often it "counts" very little even there. If we had the drive and acquisitiveness to practice our knowledge, we would soon be classed as tycoons or subversives, not placid members of the Society for Mycology in Pharmacological Pedicure.

Pragmatically our responsibilities are fixed by our agreements with others, notably those who provide us with support. As citizens we areidden, as Glass puts it, to minister to the needs of society, but voluntary do-gooding is an assumption of responsibility not yet in the contract, and it can be our own undoing.

W. F. Hollander
Department of Genetics,
Iowa State College, Ames

It is all too easy to string together a few quotations taken out of context and so convey an altogether misleading impression of superficiality and inconsistency. Personal correspondence from W. F. Hollander, much milder in tone than his communication to Science, indicates that he read not merely the excerpts of my address which were printed in Science but the full text, which was printed in the AIBS Bulletin. I am therefore all the more surprised that he makes so false an interpretation of my views, which, being a personal credo, I certainly do not expect every biologist to accept. I can reply within brief space to only a few of the erroneous conclusions Hollander has drawn.

The original text will show that I spoke of the biologist's responsibilities on three distinct levels: to himself, to his profession, and to society. It was in regard to the first that I said, "our first responsibility as biologists is really to be biologists," and the entire context will show that this carried no inference about detachment from society. My point was simply that biologists should exert themselves to maintain a working acquaintance with the entire scope of biology, should be biologists first and specialists second. There isn't the slightest conflict in that thought with what Hollander pleases to call "evangelism" and which I called teaching. This falls on the third level of responsibility. My point here is...
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a simple one: At the present tempo of social change and scientific advance, we cannot confine ourselves to teaching children, and only children, in the hope that when, 20 years from now, they become adults they will act and vote more intelligently in matters affecting the relations of science to government and to society. That will be very well, but it is imperative to attempt some education of present adults, including congressmen, governors, and even Presidents, if an understanding of science adequate for the framing of policy, especially in relation to the governmental support of basic research, is to become developed in time. The real difficulty is to distinguish between education in scientific understanding and the promotion of political views, as the debate between Linus Pauling and Edward Teller demonstrates. But however much Hollander might want to call the Bulletin of the Atomic Scientists "evangelism," I feel personally that it has been one of the most significant and influential developments of the postwar activities of scientists, and biologists might well emulate that example.

Second, to say of me that "while condemning authority he really would not object to some sort of benedict [sic] aristocracy or technocracy" reveals very careless reading of my remarks, since I was at pains to point out the danger of anarchy and tyranny if scientists were to continue increase in power while the populace remained content to accept the benefits of science in superstitious awe and credulity. Hollander's next paragraph, on the "plain fact . . . that scientists are only human, with the usual foibles and inconsistencies," is an eloquent amplification of my own remarks to the same effect in the very address he is criticizing—remarks which were made to emphasize, just as he does, that biologists are hardly prepared to take over the reins of government and society. Political inexperience is but one reason; but that it does exist seems evident from the fact that, on the National Science Board, only three out of 24 appointments were biologists, and that Killian's Scientific Advisory Committee to the President likewise includes only three biologists out of 19 members. The growing influence of the American Institute of Biological Sciences is calculated gradually to bring about a more appropriate representation of biologists on important advisory boards. But lest I be misunderstood again, let me say emphatically that I do not advocate "voluntary do-gooding," whatever that is, but rather the responsible service of biologists in more numerous advisory and educational capacities.